

ATTITUDES AND PERCEPTIONS TOWARD HAND HYGIENE AMONG HEALTHCARE WORKERS CARING FOR CRITICALLY ILL NEONATES

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ABSTRACT

BACKGROUND: Infectious complications are frequent among critically ill neonates. Hand hygiene is the leading measure to prevent healthcare-associated infections, but poor compliance has been repeatedly documented, including in the neonatal setting. Hand hygiene promotion requires a complex approach that should consider personal factors affecting healthcare workers' attitudes.

OBJECTIVE: To identify beliefs and perceptions associated with intention to comply with hand hygiene among neonatal healthcare workers.

METHODS: An anonymous, self-administered questionnaire (74 items) based on the theory of planned behavior was distributed to 80 neonatal healthcare workers to assess intention to comply, attitude toward hand hygiene, behavioral and subjective norm perceptions, and perception of difficulty to comply. Variables were assessed using multi-item measures and answers

to 7-point bipolar scales. All multi-item scales had satisfactory internal consistency ($\alpha > 0.7$). Multivariate logistic regression identified independent perceptions or beliefs associated with a positive intention to comply.

RESULTS: The response rate was 76% (61 of 80). Of the 49 nurses and 12 physicians responding, 75% believed that they could improve their compliance with hand hygiene. Intention to comply was associated with perceived control over the difficulty to perform hand hygiene (OR, 3.12; CI₉₅, 1.12 to 8.70; $P = .030$) and a positive perception of how superiors valued hand hygiene (OR, 2.89; CI₉₅, 1.08 to 7.77; $P = .035$).

CONCLUSION: Our data highlight the importance of the opinions of superiors and a strong perceived controllability over the difficulty to perform hand hygiene as possible internal factors that may influence hand hygiene compliance (*Infect Control Hosp Epidemiol* 2005;26:305-311).

During the past four decades, remarkable advances in medicine have improved the survival of extremely sick neonates, particularly very low birth weight infants. This has created a unique patient population at high risk for healthcare-associated infections secondary to their need for invasive monitoring and supportive care. Although hand hygiene is considered as the leading measure to prevent healthcare-associated infections,¹ poor compliance has been widely documented.² In most studies conducted in the neonatal setting, compliance with hand hygiene has not exceeded 50%.³⁻⁵ Furthermore, interventions to promote hand hygiene across all settings have frequently resulted in limited or only transient improvement in compliance.⁶

Promotion of hand hygiene behavior is a complex issue.^{2,7,8} Observed compliance with hand hygiene recommendations is influenced by gender, professional activity, workload, and type, tolerance, and accessibility of hand hygiene agents.² Moreover, the importance of an organiza-

tional climate to support and modify hand hygiene behavior has been consistently demonstrated.^{9,10} Compliance with hand hygiene varies significantly among healthcare workers within the same institution,¹¹ suggesting that individual factors could play a role in determining behavior.

Individual factors such as social cognitive and psychological determinants (ie, knowledge, attitude, intentions, beliefs, and perceptions) may provide additional insight into hand hygiene behavior.^{12,13} In other areas of healthcare promotion, the application of social cognitive models in intervention strategies has regularly resulted in a change toward positive behavior.¹⁴ The social cognitive models, developed during the latter half of the 20th century, were born from the assumption that an individual's perceptions have a strong impact on his or her behavior and can accurately predict human behavior.¹⁴ The current study used the framework of the theory of planned behavior¹⁵⁻¹⁷ to evaluate cognitive determinants of hand hygiene behavior. This theory has been widely applied to predict

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Supported by a grant from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Nr 200694/99-5 (CLP-S).

and explain behaviors and behavioral intentions in diverse social situations^{14,17} and in the healthcare setting^{18,19} and, recently, to understand adherence to hand hygiene among nurses.²⁰ According to this theory, behavior can be predicted from intention, which, in turn, is shaped by personal attitude, perceived behavioral control, and subjective norms.¹⁶ Thus, intention is assumed to be the most immediate factor to determine a behavior.¹⁶ Attitude toward a given behavior is determined by beliefs about the consequences of the behavior and the evaluation of these.¹⁶ Perceived behavioral control reflects beliefs regarding the access to resources and opportunities needed to perform a behavior.¹⁶ Subjective norms represent beliefs about the expectations of important referent others toward a given behavior.¹⁶ Grube et al.¹⁷ have also emphasized the important influence of an individual's perception of the behavior of others, defined as behavioral norms. Taken together, subjective and behavioral norms represent the perceived social pressure toward a behavior.

Identification of individual cognitive factors associated with intention to perform hand hygiene may help build successful promotion strategies. So far, individual cognitive factors related to hand hygiene have not been evaluated by means of a social cognitive model among healthcare workers in the neonatal setting. Our study aimed to identify beliefs and perceptions associated with hand hygiene in this population.

METHODS

Setting

The study was conducted in May 2001 in the neonatal unit of the University of Geneva Hospitals, a large referral institution providing primary and tertiary care to residents of Geneva, Switzerland, and the surrounding area (a population of approximately 800,000). The neonatal unit is divided into two sections located in separate areas: intermediate care consists of 3 patient care pods (12 beds) and intensive care consists of 2 patient care pods (8 beds). Approximately 700 neonates (5,200 patient-days) are admitted to the unit annually. The average patient-to-nurse ratio is 3:2 and 1:1 in the intermediate care and intensive care sections, respectively. Clinical staff includes 17 physicians and 84 registered nurses.

Hand hygiene facilities are conveniently located throughout the unit, with one manual sink inside every pod with medicated soap (4% chlorhexidine gluconate) and paper towels. Alcohol-based handrub solution is widely available and pocket carriage of specially designed individual bottles by each healthcare worker is strongly encouraged to facilitate bedside hand antisepsis.⁹ Posters promoting hand hygiene ("talking walls") are also widely displayed throughout the institution.⁹

Study Design

A 74-item, anonymous, self-administered questionnaire was individually distributed and returned by mail.

All neonatal unit healthcare workers present during the study period ($n = 80$) were included in the survey. The institutional review board approved the study.

Self-Administered Questionnaire

Questions addressed professional category, duration of employment in the neonatal unit, year of award of professional qualification, exposure to hand hygiene posters and previous training on hand hygiene, and assessment of cognitive factors. The evaluation of cognitive factors (Table 1) was mainly based on the theory of planned behavior.^{16,17} Factors assessed included behavioral intention, defined as the cognitive representation of an individual's readiness to perform hand hygiene; personal attitude, defined as the individual's positive or negative evaluation of hand hygiene; behavioral control, defined as the individual's perception of the difficulty or ease with which hand hygiene can be performed; subjective norms, defined as the individual's perception of the opinion of his or her superior toward hand hygiene; and behavioral norms, defined as the individual's perception of peer compliance with hand hygiene. For these cognitive factors, perceptions toward hand hygiene were considered for representative types of care in each of the following defined categories^{21,22}: contact with intact skin, contact with mucous membranes, contact with biological fluids, and respiratory and vascular tract care. Cognitive factors associated with hand hygiene concerning contact with equipment related to the neonate (ie, opening of an incubator, monitor, or ventilator) were also assessed. These cognitive variables were evaluated by five groups of multi-item questions: one for intention toward hand hygiene (dependent variable) and four for possible explanatory variables. The response to each item was evaluated by a quantitative 7-point bipolar scale (Likert-type scale),^{14,15,23} anchored by opposite answers at each end (eg, never and always) (Table 1).

Two additional cognitive factors were also assessed as possible explanatory variables for intention to comply with hand hygiene: healthcare workers' perception of the risk of cross-transmission associated with noncompliance and motivation. Perception of risk of cross-transmission was measured using a percentual scale, with values ranging from 0 to 100% in 10% increments (Table 1). Motivation to improve hand hygiene was assessed by asking participants whether they thought it was possible to improve their personal compliance, with answers being yes, possibly, and no (Table 1).

Healthcare workers were also questioned about possible reasons for difficulty to comply with hand hygiene, which were measured using a 7-point bipolar scale.

Statistical Analysis

The mean score for each of the 7-point bipolar scales was calculated by summing the values of item responses and dividing by the number of items responded to on an individual level. Scores of 6.5 or higher were con-

TABLE 1
ASSESSMENT OF INDIVIDUAL COGNITIVE FACTORS RELATED TO HAND HYGIENE

Cognitive Factor	Question	Measure	No. of Items	Alpha*
Intention to comply with hand hygiene	"Do you perform hand hygiene before/after the following situation: (. . .)?"	7-point bipolar scale (never/always)	12	0.81
Attitude toward hand hygiene	"Do you consider it useful to perform hand hygiene before/after the following situation: (. . .)?"	7-point bipolar scale (useless/useful)	15	0.74
Perceived difficulty/ease to comply	"Is it difficult/easy to comply with hand hygiene before/after the following situation: (. . .)?"	7-point bipolar scale (easy/difficult)	11	0.72
Perceived subjective norm	"Do you think (an important referent other) would approve if you did not practice hand hygiene before/after the following situation: (. . .)?"	7-point bipolar scale (not at all/surely)	12	0.80
Perceived behavioral norm	"Do your colleagues perform hand hygiene before/after the following situation: (. . .)?"	7-point bipolar scale (never/always)	12	0.84
Perception of risk of transmission	"Which percentage of nosocomial infections do you think are due to bacterial contamination of hands?"	11-point scale (0–100%)	1	†
Motivation	"Do you feel that you can improve your compliance with hand hygiene?"	3-point scale (yes/possibly/no)	1	†

*The internal consistency coefficient (Cronbach's alpha) reflects the reliability of a scale. It captures the proportion of total variance that is common to all items that form the scale, which presumably corresponds to the underlying construct being measured. The remaining variance is treated as measurement error. The alpha coefficient should be greater than 0.7.

†Alpha coefficient was not evaluated for the scales that comprised one item only.

sidered as a positive disposition, and scores below this were considered as a negative answer. The reliability of each scale was estimated using Cronbach's alpha coefficient¹⁴ (Table 1) and items were discarded from further analysis when item–test correlations were below 0.20.

Logistic regression analysis was used to investigate the following cognitive factors possibly associated with intention to comply with hand hygiene: attitude, behavioral and subjective norms, behavioral control, adequate perception of risk of cross-transmission due to contamination of hands, and motivation. In both bivariate and multivariate models, intention to comply with hand hygiene, risk perception, and motivation were entered as dichotomous data and the cognitive factors measured by multi-item questions were entered as continuous values (mean score for the cognitive factor).

Intention to comply with hand hygiene was defined as the dependent variable, and individuals with a mean score for this scale of 6.5 or higher were considered to have a positive intention toward hand hygiene. Perception of risk of cross-transmission was defined as adequate if the healthcare worker responded that between 50% and 80% of healthcare-associated infections are due to contamination of hands. Motivation was considered positive if the answer to this question was yes. Explanatory variables with a level of significance of 0.25 or less were entered into a stepwise multivariate model.

The magnitude of the association between intention to comply and explanatory variables was measured by means of odds ratios (ORs) and corresponding 95% confidence intervals (CI₉₅). All tests were two-tailed, and a *P* value of less than .05 was considered statistically signifi-

cant. All analyses were conducted using Stata software (version 7; StataCorp, College Station, TX).

RESULTS

Of the 80 questionnaires distributed (65 nurses and 15 physicians), 61 (49 nurses and 12 physicians; 76%) were returned and included in the analysis. All multi-item scales had satisfactory internal consistency (Cronbach's alpha range, 0.72 to 0.84; Table 1). Two items, one in intention evaluation and one in attitude evaluation, with item–scale correlations of less than 0.20 were discarded. After these two exclusions, the reliabilities for intention to comply (11 items) and attitude toward hand hygiene (14 items) scales were 0.85 and 0.75, respectively.

Most respondents (46 of 61) believed that they could improve their own compliance with hand hygiene, and 74% (45 of 61) believed that at least half of healthcare-associated infections are associated with microbiological contamination of healthcare workers' hands. Although 43% of the respondents claimed to have never attended specific training sessions on hand hygiene conducted by the infection control team, most (86%) acknowledged their exposure to posters promoting hand hygiene at least once a week.

Table 2 lists beliefs and perceptions related to hand hygiene according to types of contact and clinical situations. A positive intention to comply with hand hygiene was found among almost 64% (39 of 61) of the respondents, but this rate was as low as 18% (Table 2) before contact with the neonate during an episode of respiratory pause and 90% of the respondents perceived it difficult to

TABLE 2
BELIEFS AND PERCEPTIONS RELATED TO HAND HYGIENE ACCORDING TO TYPES OF CONTACT AND CLINICAL SITUATIONS

Cognitive Variable	Type of Contact*										Global No. (%)
	Skin		Vascular Tract		Mucous/Biologic Fluids		After Glove Removal	Between Different Sites	After Environmental/Equipment Contact	Score (Range)	
	Before	After	Before	After	Before	After					
Intention to comply with hand hygiene	11/61† (18.0)	28/61 (45.9)	55/60 (91.7)	46/60 (76.7)	44/61 (72.1)	41/61 (67.2)	NE	NE	NE	6.5 (3.1-7)	39 (63.9)
Attitude toward hand hygiene	32/60 (53.3)	31/58 (53.5)	54/61† (88.5)	44/60 (73.3)	42/61 (68.9)	42/61 (68.9)	19/61 (31.2)	29/59 (49.2)	26/60 (43.3)	6.3 (4.9-7)	29 (47.5)
Perception of ease to comply with hand hygiene	6/61* (9.8)	52/61 (85.3)	51/61 (83.6)	52/61 (85.3)	48/61 (78.7)	41/61 (67.2)	NE	13/60 (21.7)	21/61 (34.4)	6.0 (4-7)	13 (21.3)
Subjective norms toward hand hygiene	33/59 (55.9)	30/59 (50.9)	55/60 (91.7)	40/59 (67.8)	39/59 (66.1)	37/59 (62.7)	25/59 (42.4)	NE	29/60 (48.3)	6.2 (4-7)	25 (42.4)
Behavioral norms toward hand hygiene	14/53 (26.4)	12/52 (23.1)	39/53 (73.6)	27/53 (50.9)	27/54 (50.0)	16/54 (29.7)	9/52 (17.3)	NE	10/54 (18.5)	5.7 (3.5-7)	9 (17.0)

NE = not evaluated.

*Number of respondents who answered positively (mean individual score of 6.5 or greater)/total number of respondents (%).

†During a neonatal respiratory pause.

‡Cronbach's alpha coefficient below 0.20, and items were discarded from further analysis.

perform hand hygiene in this situation. Most respondents considered it useful to perform hand hygiene (53% to 89%), as expressed by a positive attitude either before or after any type of direct contact with the patient. On the other hand, a positive attitude toward hand hygiene for care of different body sites of the same patient, after contact with equipment linked to the neonate, and after glove removal was verified among only 49%, 43%, and 31% of the respondents, respectively. Of note, a majority (47 of 60; 78%) of the respondents perceived hand hygiene during care of different body sites of the same patient a difficult task. Although most participants reflected a positive perception of their superior toward hand hygiene during patient contact, this attributed perception was less than 50% concerning contact with the environment and after glove removal. The perception of peers' compliance with hand hygiene was dramatically low, exceeding 50% only before vascular catheter manipulation.

Cognitive Factors Associated With Intention to Comply With Hand Hygiene

The mean score for intention to perform hand hygiene was 6.5 (standard deviation, ± 0.7 ; range, 3.1 to 7). On bivariate analysis, a positive attitude, a strong behavioral control, and a positive perception of superiors' values toward hand hygiene were significantly associated with intention to comply (Table 3). In the multivariate model, only a perceived control over the difficulty to perform hand hygiene (OR, 3.1; CI₉₅, 1.1 to 8.7; $P = .030$) and a positive perception of superiors toward hand hygiene (OR, 2.9; CI₉₅, 1.1 to 7.8; $P = .035$) were independently associated with intention to comply with hand hygiene.

Reported Reasons for Difficulty to Perform Hand Hygiene

Skin irritation, a preference for the use of gloves, and failure to remember were reported by more than half of the healthcare workers as the main reasons for perceiving compliance with hand hygiene as a difficult task (Table 4).

DISCUSSION

In this study, the perception of a positive opinion of a superior toward hand hygiene and the perception of control over hand hygiene behavior were independently associated with intention to perform hand hygiene. In different applications of the theory of planned behavior model, the relative importance of the cognitive factors associated with intention has varied according to the type of behavior and social group. For instance, smoking intention among teenagers is more strongly determined by behavioral norms (ie, peer behavior) than by subjective norms (ie, parental approval).¹⁷ This model has been applied to test the association of individual cognitive factors with actual hand hygiene behavior among nurses working in medical-surgical intensive care units.²⁰ Consonant with our results, the latter study disclosed control beliefs and subjective norms as significantly associated with intention to perform hand hygiene.²⁰

TABLE 3
RESULTS OF BIVARIATE ANALYSIS OF PERCEPTIONS AND BELIEFS ASSOCIATED WITH INTENTION TO COMPLY WITH HAND HYGIENE AMONG NEONATAL HEALTHCARE WORKERS AT THE UNIVERSITY OF GENEVA HOSPITALS

	No.	Mean Individual Score (\pm SD)	OR* (CI ₉₅)	P
Attitude toward hand hygiene	61	6.3 [†] (\pm 0.6)	3.32 (1.17–9.39)	.02 [‡]
Perception of ease to comply with hand hygiene	61	6.0 [†] (\pm 0.6)	4.01 (1.49–10.82)	.01 [‡]
Subjective norms toward hand hygiene	59	6.2 [†] (\pm 0.7)	3.37 (1.32–8.58)	.01 [‡]
Behavioral norms toward hand hygiene	53	5.7 [†] (\pm 0.9)	0.60 (0.33–1.10)	.10 [‡]
Adequate perception of risk of transmission	61	63.9 [§]	1.02 (0.34–3.03)	.86
Motivation	61	75.4 [¶]	0.57 (0.16–2.05)	.39

SD = standard deviation; OR = odds ratio; CI₉₅ = 95% confidence interval.

*OR of high intention to comply (score = always) for positive attitudes and beliefs (score > 6.5).

[†]Maximal score = 7.

[‡]Variables included in the multivariate model.

[§]Percentage of healthcare workers who perceived that 50% to 80% of healthcare-associated infections were due to contamination of hands.

[¶]Percentage of healthcare workers who felt motivated to improve their compliance with hand hygiene.

Our finding that intention to perform hand hygiene among neonatal healthcare workers is influenced by how they perceive the opinions of important referent others toward the practice is consistent with other studies.²⁴⁻²⁶ Seto et al.²⁴ demonstrated that transmission of information by opinion leaders was significantly more effective for implementing a new guideline on urinary catheter care than were other strategies. The importance of the role model has been observed previously²⁵ and used successfully as an integral part of campaigns promoting hand hygiene in the intensive care setting.^{10,27-29} Conversely, the perception of being a model to other colleagues was independently associated with better compliance with hand hygiene among physicians.²⁶ These studies suggest that when opinion leaders become aware of their influential power, they are more compliant and their commitment may have a positive impact on healthcare workers' perceptions and intention to comply with hand hygiene.

Levin³⁰ tested the theories of reasoned action and planned behavior models as predictors of healthcare workers' glove use. Similar to our findings, perceived control was the variable that contributed most to the understanding of intentions toward the respective behavior.³⁰ The construct of perceived control deals with the ease or difficulty of performing a behavior and relates to past experiences, resources, opportunities, and barriers to performing the behavior.¹⁶ In particular, perceived behavioral control has a direct effect on behavior when the behavior is not completely under the individual's control and the individual's perception of control is accurate.¹⁶ Compliance with hand hygiene requires minimal objective conditions to be attained, such as availability of facilities and adequate products. The implemented method of hand hygiene also influences compliance, and the use of an alcohol-based handrub preparation for hand hygiene, recently defined as the standard of care,³¹ has been associated with marked improvement of compliance.^{9,28,32-34}

TABLE 4
REPORTED BARRIERS TO APPROPRIATE HAND HYGIENE AMONG NEONATAL HEALTHCARE WORKERS AT THE UNIVERSITY OF GENEVA HOSPITALS

Reported Barrier	No. of Respondents	No.* (%)
My hands are damaged	61	35 (57.4)
I prefer to use gloves	60	32 (53.3)
I don't remember that I have to perform hand hygiene	61	31 (50.8)
There's no time because the duration of neonatal care should be short	61	25 (41.0)
The sink is far away	60	25 (41.0)
We don't have enough handrub solution in stock	61	21 (34.4)
Hand hygiene interferes with the practice of care	60	11 (18.3)

*Number referring to the barrier.

Another key point for compliance with hand hygiene is to avoid understaffing and overcrowding situations.³⁵ These conditions are defined by the institution and strongly affect the healthcare worker's past experiences. Ajzen¹⁶ suggests that past experiences shape social cognitive variables, which, in turn, determine behavior. Therefore, it can be postulated that once good working conditions are guaranteed, the actual and perceived individual control over hand hygiene might improve, with a positive subsequent effect on hand hygiene behavior.

Several studies have challenged the assumption that the predictors in the theory of planned behavior are sufficient to account for intentions and behavior.³⁶ In the current study, the perception of risk and motivation to

improve compliance showed no significant association with intention to perform hand hygiene on bivariate analysis and were not included in the final prediction model. The addition of risk perception was shown to be a significant but minor predictor of intention to use gloves among healthcare workers³⁰ and did not add significantly to the prediction of using gloves. In other behavioral domains, the inclusion of additional cognitive factors has been shown to have only a minor (or even no) impact on the ability to predict intentions or behavior.³⁷

Hand hygiene is a repetitive action that may lead to the formation of a habit, and habits can influence behavior independent of cognitive factors.³⁷ Studies that included the measure of frequency of past behavior in the planned behavior model suggest that intentions may become largely irrelevant when behavior has become a habit. At this point, the issue becomes whether intention plays a role in determining hand hygiene behavior. In the study by O'Boyle et al.,²⁰ the cognitive factors proposed by the theory of planned behavior framework predicted intention to comply with hand hygiene, but neither these factors nor intention predicted observed hand hygiene.²⁰ By contrast, however, the belief of being a role model to other colleagues, used as a surrogate for the perceived subjective norm,¹⁶ was independently and positively associated with observed hand hygiene among physicians after adjusting for multiple parameters associated with compliance.²⁶

Some limitations regarding this study should be acknowledged. First, infection control staff, frequently involved with activities promoting hand hygiene, distributed the questionnaire and this might have reinforced social desirability bias. Second, the measure of intention to perform a sensitive behavior such as hand hygiene may reflect social pressure, environmental pressure, or both rather than the individual's real intention. This is a problem for all self-assessments. One way to alleviate it is by asking intention in a circumspect way,¹⁴ as was done in our study. Third, whether our findings can be generalized to other groups of healthcare workers remains to be tested, considering that infrastructure, past experience, and social and institutional backgrounds influence behavior.

Neonatal medicine has evolved spectacularly during the past four decades and, in parallel, the field of infection control has accumulated a large body of evidence-based recommendations to prevent hospital-associated infections. Emphasis has been given to the importance of education to disseminate information. It has not been enough.^{38,39} The time has come to gather knowledge from behavioral sciences into infection control strategies^{1,40} to help prevent and control infections among neonates admitted to special care units. The current study revealed the perception of the opinions of important referent others and the perception of control over hand hygiene as individual factors independently associated with intention to perform hand hygiene among neonatal healthcare workers. Further studies are needed to delineate the

importance of individual cognitive factors for hand hygiene behavior and to help design successful promotion strategies.

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