



CHICAGO JOURNALS



Understanding Practice: Factors That Influence Physician Hand Hygiene Compliance

Author(s): Janet E. Squires, PhD; Stefanie Linklater, MSc; Jeremy M. Grimshaw, PhD; Ian D. Graham, PhD; Katrina Sullivan, MSc; Natalie Bruce, MScN; Kathleen Gartke, MD; Alan Karovitch, MD; Virginia Roth, MD; Karen Stockton, MHS; John Trickett, BScN; Jim Worthington, MD; Kathryn N. Suh, MD

Source: *Infection Control and Hospital Epidemiology*, Vol. 35, No. 12 (December 2014), pp. 1511-1520

Published by: [The University of Chicago Press](#) on behalf of [The Society for Healthcare Epidemiology of America](#)

Stable URL: <http://www.jstor.org/stable/10.1086/678597>

Accessed: 02/12/2014 12:43

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The University of Chicago Press and The Society for Healthcare Epidemiology of America are collaborating with JSTOR to digitize, preserve and extend access to *Infection Control and Hospital Epidemiology*.

<http://www.jstor.org>

ORIGINAL ARTICLE

Understanding Practice: Factors That Influence Physician Hand Hygiene Compliance

Janet E. Squires, PhD;^{1,2} Stefanie Linklater, MSc;² Jeremy M. Grimshaw, PhD;^{2,3} Ian D. Graham, PhD;²
 Katrina Sullivan, MSc;² Natalie Bruce, MScN;⁴ Kathleen Gartke, MD;⁵ Alan Karovitch, MD;³
 Virginia Roth, MD;^{3,4} Karen Stockton, MHSc;⁴ John Trickett, BScN;⁵
 Jim Worthington, MD;⁶ Kathryn N. Suh, MD^{3,4}

OBJECTIVE. To identify the behavioral determinants—both barriers and enablers—that may impact physician hand hygiene compliance.

DESIGN. A qualitative study involving semistructured key informant interviews with staff physicians and residents.

SETTING. An urban, 1,100-bed multisite tertiary care Canadian hospital.

PARTICIPANTS. A total of 42 staff physicians and residents in internal medicine and surgery.

METHODS. Semistructured interviews were conducted using an interview guide that was based on the theoretical domains framework (TDF), a behavior change framework comprised of 14 theoretical domains that explain health-related behavior change. Interview transcripts were analyzed using thematic content analysis involving a systematic 3-step approach: coding, generation of specific beliefs, and identification of relevant TDF domains.

RESULTS. Similar determinants were reported by staff physicians and residents and between medicine and surgery. A total of 53 specific beliefs from 9 theoretical domains were identified as relevant to physician hand hygiene compliance. The 9 relevant domains were knowledge; skills; beliefs about capabilities; beliefs about consequences; goals; memory, attention, and decision processes; environmental context and resources; social professional role and identity; and social influences.

CONCLUSIONS. We identified several key determinants that physicians believe influence whether and when they practice hand hygiene at work. These beliefs identify potential individual, team, and organization targets for behavior change interventions to improve physician hand hygiene compliance.

Infect Control Hosp Epidemiol 2014;35(12):1511-1520

Hand hygiene is recognized globally as a leading measure to reduce healthcare-associated infection.¹⁻⁴ Hand hygiene compliance, however, is unacceptably low.^{5,6} Physicians in particular are repeatedly observed as being poor compliers.⁶ Promotion of hand hygiene is a complex issue.² To develop interventions with more pronounced and sustainable effects, knowledge of the behavioral determinants to hand hygiene is needed.⁷ While factors related to nurses' noncompliance has been studied frequently,⁷⁻⁹ reasons for low compliance among physicians are less well understood. Studies investigating healthcare workers generally (which sometimes include a small sample of physicians) have reported a range of barriers, including environmental (eg, lack of access to sinks, difficulty of locating products, empty or broken dispensers,

and time constraints) and personal (eg, attitudinal beliefs, skin irritation from repeated hand washing) barriers.^{10,11} Additional barriers specific to physicians identified or postulated include educational gaps in infection control training,¹²⁻¹⁴ a perception that their compliance is better than it actually is,^{15,16} a more cavalier attitude toward infection control with experience,^{17,18} a lack of positive physician role models,¹⁸⁻²⁰ and the local (eg, unit, hospital) culture of patient safety.²¹

We located only 1 study that explicitly used behavioral theory to study hand hygiene compliance among physicians. Erasmus et al⁷ conducted a qualitative study framed by the theory of planned behavior; findings showed that physicians felt hand hygiene was important for self-protection but that there was little evidence that handwashing is effective in pre-

Affiliations: 1. School of Nursing, Faculty of Health Sciences, University of Ottawa, Ottawa, Ontario, Canada; 2. Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada; 3. Department of Medicine, Ottawa Hospital/University of Ottawa, Ottawa, Ontario, Canada; 4. Infection Prevention and Control, Ottawa Hospital, Ottawa, Ontario, Canada; 5. Department of Surgery, Ottawa Hospital/University of Ottawa, Ottawa, Ontario, Canada; 6. Medical Affairs, Quality and Patient Safety, Ottawa Hospital, Ottawa, Ontario, Canada.

Received May 13, 2014; accepted July 29, 2014; electronically published November 7, 2014.

© 2014 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2014/3512-0011\$15.00. DOI: 10.1086/678597

venting cross-infection. Residents/medical students also stated said that they copy the behavior of their superiors, which often leads to their noncompliance.⁷

The purpose of this study was to identify the behavioral determinants—both barriers and enablers—to physician hand hygiene compliance at 1 tertiary care hospital. The theoretical domains framework (TDF), which is a behavior change framework, guided the study. The TDF was selected because of its comprehensiveness; it represents an agreed set of key theoretical constructs that can be used to identify all (rather than a subset) of possible barriers and enablers to healthcare professional behaviors, such as hand hygiene. The TDF was developed jointly by health psychology theorists, health services researchers, and health psychologists and comprises 14 theoretical domains derived from 128 constructs from 33 different health, behavioral, and social psychology theories that explain health-related behavior change (Table 1).^{22,23} The TDF has been used previously to successfully identify the determinants of a wide range of healthcare profes-

sional behaviors, including hand hygiene with nurses.^{9,24} This is the first application of the TDF specific to physician hand hygiene compliance.

METHODS

Design and Participants

This was a descriptive qualitative study. All medical and surgical staff physicians and residents at a large Canadian tertiary care hospital at 2 campuses that are 8.4 kilometers apart were eligible to participate. A list of all eligible physicians (divided by campus and specialty) was obtained. From this list, 6 new participant lists were created: (1) staff physicians, medicine campus 1; (2) staff physicians, medicine campus 2; (3) staff physicians, surgery campus 1; (4) staff physicians, surgery campus 2; (5) residents medicine; and (6) residents surgery. Residents were not separated by campus since they worked equally across both campuses. A quasi-experimental sampling strategy was used to randomly select key informants from

TABLE 1. Theoretical Domains Framework

Theoretical domain	Definition ²²	Sample question
Knowledge	An awareness of the existence of something	Are you aware of any guidelines about hand hygiene?
Skills	An ability or proficiency acquired through practice	Were you ever trained in the proper technique for hand hygiene?
Social/professional role and identity	A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting	Is hand hygiene a standard part of your patient consultations?
Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use	How easy or difficult is it for you to practice hand hygiene? What made it easy/what made it difficult?
Optimism	The confidence that things will happen for the best or that desired goals will be attained	What do you think will happen if you are not able to practice hand hygiene?
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation	What are the benefits/negative aspects when good hand hygiene is practiced?
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	In the past, are there any personal or external incentives that you have experienced to be effective to improve hand hygiene?
Intentions	A conscious decision to perform a behavior or a resolve to act in a certain way	Do you intend to practice hand hygiene?
Goals	Mental representations of outcomes or end states that an individual wants to achieve	Considering your other priorities, on a scale of 1 to 10, with 10 being very important, how important do you think it is for you to practice hand hygiene?
Memory, attention, and decision processes	The ability to retain information, focus selectively on aspects of the environment, and choose between 2 or more alternatives	Is hand hygiene automatic, or do you need to remember or be reminded to do it?
Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior	What aspects of your work environment influence whether you practice hand hygiene?
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors	Do other team members influence your decision to practice hand hygiene?
Emotion	A complex reaction pattern involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	Do your emotions or mood ever influence whether you practice hand hygiene?
Behavioral regulation	Anything aimed at managing or changing objectively observed or measured actions	What could you personally do to increase your hand hygiene practice?

each list. The first key informant on each list was chosen at random, and the subsequent key informants were then selected according to regular intervals, known as periods. Selected key informants were informed of their selection via e-mail from a study investigator; individuals were instructed to contact the study research assistant if they were interested in participating.

Data Collection

We conducted semistructured key informant interviews. The TDF informed the development of the interview guide. Questions were open ended, and standardized prompts were available to the interviewer if needed. The interview guide was pretested with a medicine and surgery physician, resulting in some wording changes. All interviews were conducted by the study research assistant who was trained in interviewing skills, using mock interviews to ensure she was comfortable with the interview guide. Interviews were conducted by telephone between October and December 2012 and digitally recorded. Interviews were conducted until data saturation was achieved (ie, until no new themes or concepts emerged).²⁵

Data Analysis

The recordings were transcribed verbatim and verified by the interviewer prior to analysis. Analysis occurred in 3 steps and was facilitated using NVivo 10 software.

Coding. Two team members trained in qualitative analysis, using thematic content analysis, independently coded the transcripts into the 14 TDF domains, meeting frequently to review their coding and seek consensus. First, the 2 team members read the first 4 transcripts to determine a coding scheme (comprised of codes, definitions of the codes, and examples of quotes that fall under the codes) by consensus, which was then used to analyze the remaining transcripts. Inter-rater reliability was calculated using Kappa statistics in NVivo and SPSS software.

Generation of specific beliefs. Specific beliefs were generated for each utterance (coded interview quote) in all TDF domains by 1 team member and double-checked for accuracy by a second team member. A specific belief is a collection of participant responses with a similar underlying theme that suggests a problem and/or influence on the target behavior.²⁶ Belief statements were initially written to be very specific for each code; later, similar belief statements were merged to form broader statements (ie, themes). The number of interviews ($n = 42$) in which each belief statement was mentioned was tabulated to create a frequency score for the belief statements. Belief statements were counted only once per interview, even if the statement was mentioned more than once in the interview.

Identification of relevant domains. Consistent with previous studies,^{26,27} TDF domains were classified as relevant (ie, of high importance) to physician hand hygiene compliance

if there were (1) belief statements in the domain that had relatively high frequencies (ie, 5 or more physicians identified the belief in their interview), (2) conflicting beliefs in the domain (ie, where different physicians identified opposite beliefs; eg, aware of evidence linking hand hygiene to infection and not aware of evidence linking hand hygiene to infection; in case of conflicting beliefs, frequencies less than $N = 5$ were accepted), and (3) evidence of strong beliefs in the domain that may impact hand hygiene compliance (this was determined by consensus in a team meeting with the clinicians on the research team).

Ethics

Ethical approval was obtained from the hospital's research ethics board (protocol 2012040801H).

RESULTS

Inter-rater Agreement

For the last 10 interviews, the inter-rater agreement between the 2 coders responsible for coding utterances in the key informant transcripts into the 14 TDF theoretical domains was excellent ($\kappa = 0.7555$ [95% confidence interval, 0.7095–0.8014]). Inter-rater agreement for the 14 TDF domains ranged from 0.4752 to 0.9818 (Table 2). Although this initial inter-rater agreement was calculated, all disagreements between the 2 coders were discussed and resolved through consensus.

Sample Characteristics

A total of 179 participants were approached to recruit 42 key informants. Distribution across the 2 inpatient campuses, specialties (medicine, surgery), and roles (staff physician, resident) were intentionally similar through the use of stratified sampling. Most participants were male ($N = 33$ [79%]), 40 years of age or younger ($N = 23$ [55%]), had 10 years experience or less ($N = 17$ [41%]), and worked at the hospital 5 years or less ($N = 20$ [48%]; Table 3). Interviews ranged in duration from 13 to 31 minutes, with a mean interview time of 20 minutes.

Relevant Theoretical Domains

Nine of the 14 TDF theoretical domains were identified as relevant to physician hand hygiene compliance: (1) knowledge; (2) skills; (3) beliefs about capabilities; (4) beliefs about consequences; (5) goals; (6) memory, attention, and decision processes; (7) environmental context and resources; (8) social professional role and identity; and (9) social influences. Across these 9 relevant domains, a total of 53 specific beliefs were identified that had a relative frequency of 5 or more or were conflicting beliefs. Table 4 displays the specific beliefs, their frequency (ie, number of interviews in which the belief

TABLE 2. κ Calculated across Last 10 Key Informant Interviews by Theoretical Domain

Theoretical domain	κ	95% confidence interval
Relevant domains		
Knowledge	0.7918	0.7282–0.8554
Skills	0.8092	0.6905–0.9280
Beliefs about capabilities	0.8902	0.8019–0.9783
Beliefs about consequences	0.8233	0.7274–0.9192
Goals	0.6888	0.5189–0.8587
Memory, attention, and decision processes	0.6407	0.5197–0.7616
Environmental context and resources	0.6960	0.5539–0.8381
Social professional role and identity	0.8296	0.6909–0.9684
Social influences	0.7621	0.5850–0.9391
Nonrelevant domains		
Behavioral regulation	0.4752	0.1506–0.7999
Emotion	0.8184	0.6539–0.9829
Intentions	0.9818	0.9735–0.9900
Optimism	0.6639	0.3266–1.000
Reinforcement	0.7054	0.4081–1.000
Overall (all domains)	0.7555	0.7095–0.8014

was mentioned), along with a supportive quote from the interview for each belief.

Differences by Campus, Specialty, and Role

There were no notable differences in the specific beliefs identified across the 2 geographical campuses, specialties (medicine compared with surgery), or role (staff physician compared with resident), with the exception of 1 TDF domain (social influences), where there were differences by specialty.

In the majority of key informant interviews, both patient ($N = 15$ [36%]) and other team member ($N = 15$ [36%]) expectations were identified as important influences for physician hand hygiene compliance. Both surgery and medicine participants similarly identified patient's expectations as important, but the influence of other team members was notably stronger in medicine. Only 1 (9%) surgery staff felt that other team members influenced their hand hygiene practice compared with 4 (40%) surgery residents, 5 (45%) medicine staff, and 5 (50%) medicine residents. Similarly, while 18 (43%) of all participants stated that other team members do not influence their practice, twice as many surgery staff ($N = 12/21$ [57%]) stated this compared with medicine staff ($N = 6/21$ [29%]).

DISCUSSION

Although hand hygiene is a simple procedure to perform, its application in practice, especially by physicians, is a complex phenomenon not easily explained or changed.^{2,28,29} Behavioral research into hand hygiene is therefore highly needed in order to identify the determinants of its use.^{7,12,30} To our knowledge, this is the first study to use the TDF to explore the determinants of physician hand hygiene compliance. By using this specific behavioral theory approach, a comprehensive and

systematic understanding of the determinants of physician hand hygiene compliance was possible. The determinants—which ranged from individual beliefs to organizational and social contexts—hold potential as targets for behavior change interventions to improve physician hand hygiene compliance.

Previously, Pittet et al² conducted a survey of physician practices, beliefs, and attitudes toward hand hygiene. They found that physician compliance with hand hygiene was largely a function of their environmental context, social pressure, perception of risk of cross-contamination, and a positive attitude toward hand hygiene itself. Our study confirmed these findings but explored each determinant in more detail to create specific beliefs around them that can be used in future intervention studies to improve compliance. We also significantly expanded on Pittet's study by identifying many additional barriers as well as enablers to physician hand hygiene compliance. In total, we identified 53 specific physician beliefs from 14 behavioral domains that can be used as targets in future interventions.

Knowledge and skills were important for physician hand hygiene compliance in our study. Consistent with previous research,^{2,7} we anticipated finding a knowledge gap with respect to awareness of evidence linking hand hygiene to the development of healthcare-associated infections. However, we did not anticipate a large knowledge gap related to awareness of hand hygiene guidelines or a skill gap in how to properly perform hand hygiene. These behavioral domains have not been previously assessed, perhaps because they are considered basic training for all healthcare providers, including physicians. Their identification in this study, however, warrants their continued investigation and also their consideration as targets for action in interventions to improve physician hand hygiene compliance.

TABLE 3. Sample Characteristics (*N* = 42)

Characteristic	<i>N</i> (%)
Specialty and role	
Medicine staff	11 (26)
Medicine resident	10 (24)
Surgery staff	11 (26)
Surgery resident	10 (24)
Sex	
Male	33 (79)
Female	9 (21)
Age, years	
<30	5 (12)
31–40	18 (43)
41–50	10 (24)
51–60	6 (14)
61+	3 (7)
Experience, years	
0–5	13 (31)
5.1–10	4 (10)
10.1–15	6 (14)
15.1–20	4 (10)
20+	12 (28)
Missing ^a	3 (7)
Time at hospital, years	
0–5	20 (48)
5.1–10	9 (21)
10.1–15	5 (12)
15.1–20	1 (2)
20+	7 (17)

^a Missing for 3 key informants: 1 medicine staff and 2 surgery residents.

Memory, attention, and decision processes were also important to hand hygiene compliance in this study. It is commonly assumed that all healthcare workers, including physicians, perceive hand hygiene as a routine procedure to carry out when providing patient care; our findings did not support this. In fact, the majority of the physicians interviewed felt hand hygiene required a conscious decision and that reminders to practice hand hygiene were necessary. We located no previous studies that examined the effectiveness of reminders alone to improve physician hand hygiene compliance. However, some studies have found multimodal interventions (which included a reminder component) to be successful.^{31,32} In these studies, reminders were in the form of displayed posters. In our interviews and team discussions, visual reminders were also felt to have potential for success; for example, colored stickers on hand hygiene alcohol stations were suggested. Our finding that hand hygiene is not automatic for physicians was also noted in a previous study by Erasmus et al,⁷ who found that forgetfulness was a barrier to physician hand hygiene compliance. Interesting, this differs from behavioral hand hygiene research conducted among nurses; Boscart et al,⁹ in a similar qualitative study to ours but conducted with nurses, found that hand hygiene was largely a routine and automatic process.

Social influences, particularly of patients and colleagues, were important considerations to physicians in their hand hygiene practice. We located no previous work that investigated the role of patient expectations on physician (or any healthcare providers') hand hygiene behavior. One study examining this influence on nursing hand hygiene did not show patient expectations to be a consideration.⁹ Future exploration of the role of patients in influencing physician hand hygiene would be a fruitful avenue for research. There is evidence that supports the influence of colleagues on hand hygiene compliance. Role models are known to play a central role in changing physician behavior generally^{2,33} and to improve physician hand hygiene compliance specifically,^{2,7,34} yet they are seldom used in interventions to change physician hand hygiene.³⁵ Similar to role models is the concept of positive deviance, which refers to a social and behavioral change process based on the premise that in most organizations there are people who solve problems better than colleagues with the exact same resources.^{36–38} Positive deviance has been used successfully in several studies to improve healthcare providers' hand hygiene compliance rates.^{36,37,39}

Interestingly, we found a difference among specialties with regard to the influence of other team members on hand hygiene practices, indicating that the importance of social influences may vary by specialty. In our study, fewer surgery than medicine physicians stated that other team members influenced their hand hygiene practice. This may be due to sample size but may also be explained by the nature of the work of the 2 specialties investigated in this study. For example, surgeons are required to work more independently than are medicine physicians (who tend to work more in teams); therefore, surgeons may look less on their colleagues for examples of how to practice.

System constraints (environmental context and resources) were consistently and frequently expressed as important barriers and enablers to hand hygiene compliance. A dominant theme across almost all (98%) participants was the importance of easy access to hand hygiene resources at the point of patient contact. This is consistent with previous studies of physician hand hygiene in hospitals generally^{2,6} and in specialty (intensive care) units,^{36,37} indicating that there may be some behavioral determinants of physician hand hygiene compliance that are common across hospital specialties. High workloads also surfaced as a system constraint in our study. While this is not new,^{2,6} we believe that we are among the first to capture this barrier at the individual physician level.

The fact that we were able to identify multiple behavioral determinants to physician hand hygiene compliance suggests that intervention strategies to change this behavior will need to be multifaceted. On the basis of this study, possible actions may include education (eg, disseminating hand hygiene guidelines and evidence linking hand hygiene to healthcare-associated infections), skills development (eg, on hand hygiene technique), motivation (eg, to increase the priority assigned to hand hygiene), and system change (eg, to improve

TABLE 4. Belief Statements for Relevant Theoretical Domains from Key Informant Interviews (N = 42)

Domain and specific belief	N (%)	Interview quote
Knowledge		
I believe that what I consider to be good hand hygiene fits with current guidelines	33 (79)	Q: Are you confident that what you consider to be good hand hygiene is in accordance with the current guidelines? A: I do, I think so, and based upon what I do, it tends to be from how I have been instructed to wash my hands and carry on practice, so I would hope so. (Medicine resident)
I am not confident that what I believe to be good hand hygiene fits with current guidelines	2 (18)	Q: Are you confident that what you consider to be good hand hygiene is in accordance with the current guidelines? A: Umm, probably not completely. (Medicine resident)
I am aware of hand hygiene guidelines and/or have heard of the 4 moments of hand hygiene	28 (67)	Q: Are you aware of any guidelines about hand hygiene? A: Uh, I know there are, but I've never really, like, read them or looked into them. Q: So are you familiar with the term "the 4 moments of hand hygiene"? A: Yes, sounds familiar. (Surgery resident)
I am not aware of hand hygiene guidelines and/or the 4 moments of hand hygiene	14 (33)	A: I know there are [hand hygiene guidelines], but I've never really, like, read them or looked into them. (Surgery resident) A: With the 4 what? No, I don't recall them. (Medicine staff physician)
I am aware of evidence linking hand hygiene to healthcare-associated infections	27 (64)	A: Certainly, I've seen a number of studies. I wouldn't be able to quote them, but you know they have a lot of biologic possibilities, so I'd probably just look at the abstract and agree with it. (Medicine staff)
I am not aware of evidence linking hand hygiene to healthcare-associated infections	9 (21)	Q: Are you aware of any evidence that links hand hygiene to healthcare-associated infections? A: Not that I've read, but I guess it makes sense. (Surgery staff)
Skills		
I consider hand hygiene a skill	26 (62)	A: You can go in and say, "Oh, yeah, I washed my hands," but did you really wash your hands, did you really scrub them to get them clean? So yeah, it is a skill. (Medicine staff)
I do not consider hand hygiene a skill	10 (24)	A: I wouldn't call it a skill, no. I mean, I think, like, a skill is something that takes a lot of time to be able to perfect. I think it's [hand hygiene] something that if you've seen it and you know you're instructed on doing it, if you just repeat it a couple of times, it just becomes a routine thing. (Medicine resident)
I have had training in hand hygiene practice	26 (62)	Q: Were you ever trained in the proper technique for hand hygiene? A: I believe so ... I cannot recall specifically, but yes, I had, like, I think it was videos showing how to do, like, you know when it's with alcohol, and then I had a specific one for doing the [surgical] scrubbing, I think. (Surgery resident)
I have not had training in hand hygiene practice	15 (36)	A: I don't think I was ever trained, no. (Surgery staff)
Beliefs about capabilities		
Hand hygiene is easy to practice	36 (86)	A: It couldn't be any easier. The stuff [alcohol gel] is all over the place. (Medicine staff)
Hand hygiene is difficult to practice	8 (19)	Q: Are there any competing tasks or time constraints that might influence whether or not you practice hand hygiene? A: Well, I think, like, we were kind of saying, if you were in a situation where you're trying to do too much and you're carrying things in and out of rooms and what have you, it's not that you wouldn't be trying to practice hand hygiene but that you might not be able to do it as effectively, right. (Medicine resident)
I am confident that I am following hand hygiene guidelines when practicing hand hygiene	20 (48)	Q: Are you confident that you are following the guidelines when practicing hand hygiene? A: Again, to the extent that I know them, I believe I am, yes. (Surgery staff)
I am not confident that I am following hand hygiene guidelines when practicing hand hygiene	6 (14)	Q: Are you confident that you are following the guidelines when practicing hand hygiene? A: I don't think so, not strictly, not all of them anyway. (Surgery staff)
When there is an emergency situation, I am less likely to practice hand hygiene	14 (33)	A: Life-threatening situations. I mean, I don't see myself, you know, looking for a sink when a patient is having a cardiac arrest. (Medicine staff)
Beliefs about consequences		
Practicing hand hygiene reduces the transmission of infection	41 (98)	A: The benefits [of hand hygiene] would be, like, decreased intrahospital spread of infection would be, I think, 1 important measure. (Medicine resident)
Practicing hand hygiene damages my hands	22 (52)	A: I mean, it [practicing hand hygiene] doesn't affect me with a 1-time use or a 2-time use, but if it's a consistent over time use, my hands begin to get dry and cracked, and then I get real issues if I use soaps. (Surgery staff)
It is very likely that improper hand hygiene will lead to a healthcare-associated infection	14 (33)	Q: In your opinion, how likely is it that improper hand hygiene will lead to a healthcare-associated infection? A: I think it could be very likely, depending especially on the patient you're treating and the next patient you're going to after that. (Medicine staff)
It is likely that improper hand hygiene will lead to a healthcare-associated infection	10 (24)	Q: In your opinion, how likely is it that improper hand hygiene will lead to a healthcare-associated infection? A: Not, I can't give you numbers. I wouldn't know, but I think it's pretty likely. (Surgery resident)
It is somewhat likely that improper hand hygiene will lead to a healthcare-associated infection	11 (26)	Q: In your opinion, how likely is it that improper hand hygiene will lead to a healthcare-associated infection? A: How likely? I guess somewhat likely. (Medicine staff)

TABLE 4 (Continued)

Domain and specific belief	N (%)	Interview quote
It is unlikely that improper hand hygiene will lead to a healthcare-associated infection	3 (7)	A: I think it's rare, but probably the risk is not zero, but it's very small. (Surgery staff)
There are no negative aspects to practicing hand hygiene	11 (26)	A: There is no negative aspect. (Surgery staff)
Goals		
Hand hygiene is always a necessity	14 (33)	Q: In what situations do you think hand hygiene is unnecessary? A: I'm not sure if any situation. I think hand hygiene is always necessary. (Surgery resident)
When taking all priorities into consideration, hand hygiene is a 10	12 (29)	Q: Considering your other priorities on a scale of 1–10, with 10 being very important, how important do you think it is for you to practice hand hygiene? A: 10, yeah, 10, it's critical. (Medicine staff)
When taking all priorities into consideration, hand hygiene is a 8–9	23 (55)	A: I would say sort of 8 out of 10, but that doesn't mean that it ranks more importantly than other things or less importantly. It's just it's an important thing to do. (Surgery resident)
When taking all priorities into consideration, hand hygiene is a 7 or less	4 (10)	Q: Considering your other priorities on a scale of 1–10, with 10 being very important, how important do you think it is for you to practice hand hygiene? A: 7. (Surgery staff)
Memory, attention, and decision processes		
Hand hygiene is an automatic process for me	30 (71)	A: No, it's not a conscious decision, no, it's unconscious for sure. I don't think about it, I do it automatically. (Surgery staff)
Easily visible hand hygiene stations makes it easier to remember to practice hand hygiene	29 (69)	A: I would say that for people that are learning to get into the rhythm, it would be putting those receptacles in visible places so that they're kind of reminders when coming in and out of rooms. (Medicine resident)
Practicing hand hygiene is a conscious decision/is not an automatic process for me	25 (60)	A: Often I'm thinking, like, where is the dispenser, like, yes, I do make it a conscious decision. (Medicine staff physician)
Not practicing hand hygiene is not a conscious decision	9 (21)	A: No, I don't think there's much of a specific "I'm not going to practice hand hygiene," but sometimes you know you may forget. (Medicine resident)
Reminders are useful for my hand hygiene practice	19 (45)	A: I need reminders ... as a human, I tend to forget from time to time, and if I have reminder in the hospital, I do it. (Surgery resident)
I do not need help remembering to practice hand hygiene	6 (14)	Q: Is there anything that would make it easier to remember hand hygiene? A: Umm, for me, I don't think it's an issue. (Medicine staff)
When not touching a patient or patient environment, hand hygiene is not always necessary	15 (36)	Q: In what situations do you think hand hygiene is unnecessary? A: I sometimes think it's unnecessary if I walk into a room just to have a quick chat with somebody, and I don't touch anybody or anything in the room. I don't think you need to maybe be as diligent in your handwashing just to have a conversation with somebody. (Medicine resident)
Practicing hand hygiene is a habit	8 (19)	A: It's a habit, and it's just part of cleanliness that goes along with everything. (Surgery staff)
There are no triggers that remind me to practice hand hygiene	7 (17)	A: I just try to do it [hand hygiene] before I go into the room, so it's kind of becomes a habit and when I leave, but the trigger, I'm not sure if I have any memory tricks. (Medicine resident)
There are no specific situations where I find myself forgetting to practice hand hygiene more often than others	7 (17)	Q: Are there certain situations where you find yourself forgetting to practice hand hygiene more often than others? A: Umm, that's a good question. I'd like to say I don't think so. You know, if I'm in, it doesn't matter if I'm in recovery room, ICU, our in-patient ward, or out-patient clinic. I mean, I think I make a pretty conscientious effort to do it in all those different locations. (Surgery staff)
There are specific situations where I forget to practice hand hygiene more often than others	18 (43)	A: I think I remember most times, but, you know, the thing is, so, for example, a patient in ICU with a, you know, someone's crashing in the unit. They're crashing in their bed, like I have done this several times, I admit, where I just walk in the room because you're just going after the patient, and then the nurses come back and say, "Well, the patient's MRSA," or "The patient's got <i>C. diff</i> ," you know, like, help, just give me a gown or something and go on, but you still, you do clearly, you still forget. (Medicine staff)
Environmental context and resources		
Easy access to hand hygiene stations makes it easier to practice hand hygiene (many subgroups if needed)	41 (98)	A: The negative aspect has to do with the time involved and especially the lack of convenience, and not just convenience, in fact, the decreased efficiency when rooms and hallways and patient encounters are not properly set up for appropriate hand hygiene. (Surgery resident)
Practicing hand hygiene takes time/time as a resource influences my hand hygiene practice	25 (60)	A: When you know you are very busy and you're pushing through a list of patients, it occupies your mind how to see your patients in a reasonable amount of time, so that's what displaces the thought of cleansing your hands before and after each visit. (Medicine resident)
Hand hygiene is not time consuming/no time constraints influence my hand hygiene practice	12 (29)	A: It's not time consuming for me because it's just so, you know, you do it as you're walking down the hall. You do it as you're walking into the room. You don't shake hands because your hands, like, you know, you do it in front of the patient. Like, you know, as long as you're multitasking while you're doing it, it's not time consuming. (Medicine staff)

TABLE 4 (Continued)

Domain and specific belief	N (%)	Interview quote
When I am busy, I am less likely to comply with hand hygiene guidelines	20 (48)	A: As well when, you know, you are very busy and you're pushing through a list of patients, you know that's the—it occupies your mind, is, you know, how to see your patients in a reasonable amount of time, so that's what displaces, you know, the thought of cleansing your hands before and after each visit. (Medicine resident)
I do not have any feelings about current hand hygiene guidelines	16 (38)	Q: Do you have any strong feelings about the current hand hygiene guidelines? A: No, I think that I'm in agreement with them, but nothing, no strong feelings. (Medicine resident)
The location of hand hygiene stations is important in facilitating hand hygiene practice	13 (31)	A: The negative aspect has to do with the time involved and especially the lack of convenience, and not just convenience, in fact, the decreased efficiency when rooms and hallways and patient encounters are not properly set up for appropriate hand hygiene. (Surgery resident)
Social professional role and identity		
Hand hygiene is a standard part of my patient consultations	40 (95)	A: In fact, I like to make it [hand hygiene] a very visible part of my patient consultation. When they first see me, I try and make sure that I'm actually still in the process of putting alcohol-based hand rub on my hands so that they know I'm performing hand hygiene. (Medicine staff)
My hand hygiene practice is in line with my peers	19 (45)	A: Everybody always thinks they're better than everybody else. No, I'm probably just average, you know. (Medicine staff)
Hand hygiene is not specific to just my specialty	14 (33)	Q: Do you think that hand hygiene is something specific to physicians in general medicine? A: I hope not. So, no. (Medicine staff)
Hand hygiene should be performed by all healthcare professionals	16 (38)	A: I think every healthcare professional has to use it [hand hygiene]. (Medicine resident)
Hand hygiene should be performed by everyone	12 (29)	A: It's something that's, uh, everybody should do. (Medicine resident)
My hand hygiene practice is better than my peers	13 (31)	A: I mean, there's going to be some physicians who do a better job of it than I do, but I would say I probably do focus on it more than the majority of them do. (Surgery staff)
Physician hand hygiene compliance is suboptimal	11 (26)	Q: What is your impression of the compliance of others in your profession with hand hygiene guidelines? A: I think it's lacking. (Surgery staff)
Social influence		
Other team members influence my hand hygiene practice	15 (36)	A: I'd say when we're rounding and when you see the staff doing it, every single person that's rounding with the staff does the same thing. (Medicine resident)
Other team members do not influence my hand hygiene practice	18 (43)	Q: Do other team members influence your decision to practice hand hygiene? A: No. (Medicine staff)
Patients expectations do not influence me to perform hand hygiene	11 (26)	A: I think they [patients and their families] have a reason to expect it [hand hygiene] from us, like I don't do it to satisfy them, their wishes. (Medicine resident)
Patients expectations influence my hand hygiene practice	15 (36)	A: Yes, indirectly of course, I think the expectation from me to provide them [patients and their families] the best care, and part of that is good hand hygiene. (Surgery resident)
I have never been asked by a patient if I have performed proper hand hygiene	12 (29)	A: No, I can't remember 1 instance of feedback from any patient or their families about it [hand hygiene]. (Surgery staff)

NOTE. A, answer; ICU, intensive care unit; MRSA, methicillin-resistant *Staphylococcus aureus*; Q, question.

access to hand hygiene resources and incorporation of reminders into daily routines). In addition to these strategies that are known to be effective at changing healthcare provider behavior generally,⁴⁰ attempts to reinforce the importance of role modeling and positive deviance strategies should also be considered.

Our study has several strengths. Interviewing residents in addition to staff physicians in 2 specialties (medicine and surgery) provided the perspectives of both key groups responsible for the majority of inpatient medical services in our hospital. Even though the participants interviewed differed in their roles and specialty, their responses around hand hygiene largely converged, indicating similar determinants to the behavior. Further, a systematic and comprehensive approach to data collection and analysis was undertaken, adding to the rigor of the research and trustworthiness of our findings. By using the TDF, which is a compilation of 33 different theories, more possible determinants of the behavior were

identified than in previous studies that relied on a single theory. For instance, we identified 53 specific physician hand hygiene beliefs compared with approximately 20 beliefs in the Erasmus⁷ qualitative study.

While we provided much needed valuable insight into the factors that may influence physician hand hygiene compliance, there were some limitations. First, while the specific beliefs identified in this study represent physicians' views about what might influence their hand hygiene compliance, they do not provide evidence of the actual influences on physician hand hygiene compliance. Second, we limited key informants to physicians and residents, but other healthcare professionals may also be able to provide valuable insight into physician hand hygiene compliance. Third, it is possible that the key informants participating in the study (who agreed to be interviewed) may differ from those who did not participate with respect to their beliefs and attitudes about hand hygiene. Finally, some of the terms used in the interview guide (eg,

guidelines) could be seen as broad. We did not attempt to operationalize these terms; therefore, they were left open to interpretation.

Our next steps involve developing an intervention—tailored to the barriers and enabler identified—to improve physician hand hygiene. The intervention will be pretested in the hospital where the physician key informants were interviewed, and if successful, a larger trial will be planned.

In summary, physician hand hygiene compliance continues to be a major challenge globally. This qualitative study demonstrated the utility in using psychological theories commonly used in knowledge translation and health psychology research to explore the determinants of hand hygiene compliance. The results provide a much-needed and better understanding of physicians' behavior change processes in relation to hand hygiene practice and should be used to inform the design of future intervention strategies to improve this behavior. Future interventions should be multifaceted and account for the knowledge and skills deficits, environmental context issues, as well as individual physician cognitive factors identified.

ACKNOWLEDGMENTS

Financial support. This study was funded by the Ottawa Hospital Academic Medical Association. J.E.S. holds a Canadian Institutes for Health Research (CIHR) New Investigator Award in Knowledge Translation. J.M.G. holds a CIHR Canada Research Chair in Knowledge Transfer and Uptake.

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

Address correspondence to Janet E. Squires, PhD, 501 Smyth Road, Box 711, Ottawa, Ontario K1H 8L6, Canada (jasquires@ohri.ca).

REFERENCES

1. Health Canada. *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*. *Can Commun Dis Rep* 1998;24S8.
2. Pittet D, Simon A, Hugonnet S, Pessoa-Silva CL, Sauvan V, Perneger TV. Hand hygiene among physicians: performance, beliefs, and perceptions. *Ann Intern Med* 2004;141:1–8.
3. World Health Organization (WHO). *WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge, Clean Care is Safer Care*. Geneva: WHO, 2009.
4. Boyce JM, Pittet D; Healthcare Infection Control Practices Advisory Committee; HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Guideline for hand hygiene in health-care settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *MMWR Recomm Rep* 2002;51:1–45.
5. Rosenthal VD, McCormick RD, Guzman S, Villamayor C, Orellano PW. Effect of education and performance feedback on handwashing: the benefit of administrative support in Argentinian hospitals. *Am J Infect Control* 2003;31:85–92.
6. Pittet D, Hugonnet S, Harbarth S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Infection Control Programme*. *Lancet* 2000;356:1307–1312.
7. Erasmus V, Brouwer W, van Beeck EF, et al. A qualitative exploration of reasons for poor hand hygiene among hospital workers: lack of positive role models and of convincing evidence that hand hygiene prevents cross-infection. *Infect Control Hosp Epidemiol* 2009;30:415–419.
8. O'Boyle CA, Henly SJ, Larson E. Understanding adherence to hand hygiene recommendations: the theory of planned behavior. *Am J Infect Control* 2001;29:352–360.
9. Boscart VM, Fernie GR, Lee JH, Jaglal SB. Using psychological theory to inform methods to optimize the implementation of a hand hygiene intervention. *Implement Sci* 2012;7:77.
10. Chagpar A, Banez C, Lopez R, Cafazzo JA. Challenges of hand hygiene in healthcare: the development of a tool kit to create supportive processes and environments. *Healthc Q* 2010;13:59–66.
11. Haas J, Larson EL. Compliance with hand hygiene guidelines: where are we in 2008? *Am J Nurs* 2008;108:40–44.
12. Pittet D, Mourouga P, Perneger TV. Compliance with handwashing in a teaching hospital. *Infection Control Program*. *Ann Intern Med* 1999;130:126–130.
13. Askarian M, Mirzaei K, Mundy LM, McLaws ML. Assessment of knowledge, attitudes, and practices regarding isolation precautions among Iranian healthcare workers. *Infect Control Hosp Epidemiol* 2005;26:105–108.
14. Stein AD, Makarawo TP, Ahmad MF. A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals. *J Hosp Infect* 2003;54:68–73.
15. Berhe M, Edmond MB, Bearman GM. Practices and an assessment of health care workers' perceptions of compliance with infection control knowledge of nosocomial infections. *Am J Infect Control* 2005;33:55–57.
16. Tibballs J. Teaching hospital medical staff to handwash. *Med J Aust* 2012;164:395–398.
17. Evanoff B, Kim L, Mutha S, et al. Compliance with universal precautions among emergency department personnel caring for trauma patients. *Ann Emerg Med* 1999;33:160–165.
18. Moore S, Goodwin H, Grossberg R, Toltzis P. Compliance with universal precautions among pediatric residents. *Arch Pediatr Adolesc Med* 1998;152:554–557.
19. Jang JH, Wu S, Kirzner D, et al. Physicians and hand hygiene practice: a focus group study. *J Hosp Infect* 2010;76:87–89.
20. Lankford MG, Zembower TR, Trick WE, Hacek DM, Noskin GA, Peterson LR. Influence of role models and hospital design on hand hygiene of healthcare workers. *Emerg Infect Dis* 2003;9:217–223.
21. Cantrell D, Shamriz O, Cohen MJ, Stern Z, Block C, Brezis M. Hand hygiene compliance by physicians: marked heterogeneity due to local culture? *Am J Infect Control* 2009;37:301–305.
22. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci* 2012;7:37.
23. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Qual Saf Health Care* 2005;14:26–33.
24. Fuller C, Michie S, Savage J, et al. The Feedback Intervention

- Trial (FIT)—improving hand-hygiene compliance in UK health-care workers: a stepped wedge cluster randomised controlled trial. *PLoS One* 2012;7:e41617.
25. Francis J, Johnston M, Robertson C, et al. What is an adequate sample size? operationalising data saturation for theory-based interview studies. *Psychol Health* 2010;25:1229–1245.
 26. Islam R, Tinmouth AT, Francis JJ, et al. A cross-country comparison of intensive care physicians' beliefs about their transfusion behaviour: a qualitative study using the theoretical domains framework. *Implement Sci* 2012;7:93.
 27. Patey A, Islam R, Francis JJ, Bryson GL, Grimshaw JM. Anesthesiologists' and surgeons' perceptions about routine preoperative testing in low-risk patients: application of the theoretical domains framework to identify factors that influence physicians' decisions to order pre-operative tests. *Implement Sci* 2012;7:52.
 28. Larson E, Killien M. Factors influencing handwashing behavior of patient care personnel. *Am J Infect Control* 1982;10:93–99.
 29. Pittet D. Improving compliance with hand hygiene in hospitals. *Infect Control Hosp Epidemiol* 2000;21:381–386.
 30. Jumaa PA. Hand hygiene: simple and complex. *Int J Infect Dis* 2005;9:3–14.
 31. Ho M-L, Seto W-H, Wong L-C, Wong T-Y. Effectiveness of multifaceted hand hygiene interventions in long-term care facilities in Hong Kong: a cluster-randomized controlled trial. *Infect Control Hosp Epidemiol* 2012;33:761–767.
 32. Tromp M, Huis A, de Guchteneire I, et al. The short-term and long-term effectiveness of a multidisciplinary hand hygiene improvement program. *Am J Infect Control* 2012;40:732–736.
 33. Eggimann P, Harbarth S, Constantin MN, Touveneau S, Chevrolet JC, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. *Lancet* 2000;355:1864–1868.
 34. Larson E, McGinley KJ, Grove GL, Leyden JJ, Talbot GH. Physiologic, microbiologic, and seasonal effects of handwashing on the skin of health care personnel. *Am J Infect Control* 1986;14:51–59.
 35. Gould D, Moralejo D, Drey N, Chudleigh J. Interventions to improve hand hygiene compliance in patient care. *Cochrane Database Syst Rev* 2010;II005186.
 36. Marra AR, Guastelli LR, de Araujo CM, et al. Positive deviance: a program for sustained improvement in hand hygiene compliance. *Am J Infect Control* 2011;39:1–5.
 37. Marra A, Guastelli L, de Araujo C, et al. Positive deviance: a new strategy for improving hand hygiene compliance. *Infect Control Hosp Epidemiol* 2010;31:12–20.
 38. Marsh DR, Schroeder DG, Dearden KA, Sternin J, Sternin M. The power of positive deviance. *BMJ* 2004;329:1177–1179.
 39. Crump M, Bryce E, Ko S, Busto G. Unleashing the positive deviants at the frontline: more than just sparking change. *Am J Infect Control* 2012;40:e31–e176.
 40. Michie S, Johnston M, Francis J, Hardeman W, Eccles M. From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Appl Psychol* 2008;57:660–680.