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Application of a theoretical framework for behavior change to hospital workers' real-time explanations for noncompliance with hand hygiene guidelines

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Background: Insufficient use of behavioral theory to understand health care workers' (HCWs) hand hygiene compliance may result in suboptimal design of hand hygiene interventions and limit effectiveness. Previous studies examined HCWs' intended, rather than directly observed, compliance and/or focused on just 1 behavioral model. This study examined HCWs' explanations of noncompliance in "real time" (immediately after observation), using a behavioral theory framework, to inform future intervention design.

Methods: HCWs were directly observed and asked to explain episodes of noncompliance in "real-time." Explanations were recorded, coded into 12 behavioral domains, using the Theory Domains Framework, and subdivided into themes.

Results: Over two-thirds of 207 recorded explanations were explained by 2 domains. These were "Memory/Attention/Decision Making" (87, 44%), subdivided into 3 themes (memory, loss of concentration, and distraction by interruptions), and "Knowledge" (55, 26%), with 2 themes relating to specific hand hygiene indications. No other domain accounted for more than 18 (9%) explanations.

Conclusion: An explanation of HCWs' "real-time" explanations for noncompliance identified "Memory/Attention/Decision Making" and "Knowledge" as the 2 behavioral domains commonly linked to noncompliance. This suggests that hand hygiene interventions should target both automatic associative learning processes and conscious decision making, in addition to ensuring good knowledge. A theoretical framework to investigate HCWs' "real-time" explanations of noncompliance provides a coherent way to design hand hygiene interventions.

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Sustained improvements in hand hygiene compliance are central to the World Health Organization's (WHO) First Global Patient Safety challenge to reduce the international burden of health care-associated infection.¹ Systematic reviews of interventions to

improve health care workers' (HCWs) hand hygiene compliance show that improvement is difficult to achieve and sustain.^{2,3} This may be, in part, due to the failure of studies to use behavioral theory in their design.⁴ Understanding the barriers to and drivers of hand hygiene from a theory-based perspective would facilitate the design of an optimally effective intervention.⁵

A recent systematic review of HCWs' compliance with hand hygiene guidelines in hospital⁶ suggested that insufficient use of behavioral theory has limited our understanding of hand hygiene behavior. This may have arisen for 2 reasons. First, previous studies have generally linked predictors of hand hygiene with HCWs' intended or self-reported behavior rather than their actual directly observed behavior. This is despite the fact that there are

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well-recognized discrepancies between the two.^{7,8} Second, studies have often focused on one model of behavior, such as the Theory of Planned Behavior,⁹ although one theory or model is unlikely to encapsulate the wide range of influences on hand hygiene behavior cited in the literature.¹⁶

The Theoretical Domains Framework (TDF)^{10,11} is a well-validated, comprehensive, consensus-based, theoretical framework for understanding implementation of health care guidelines. It uses a core set of 12 theoretical domains based on psychologic theories and constructs relevant to implementation of evidence-based practice, accompanied by exemplar interview questions to elicit which domains are relevant to any given behavior. To improve design of future hand hygiene interventions, we used the TDF to analyze HCWs' explanations of their noncompliant hand hygiene behavior recorded in "real time" (ie, shortly after direct observation).

METHODS

Design

A cross-sectional study was used, nested within a cluster randomized controlled trial of a hand hygiene intervention, the Feedback Intervention Trial (FIT) (Controlled-Trials.com ISRCTN65246961). Ethical approval for the study was received from the Scotland B Multicentre Research Ethics Committee 05/MREC10/2.

Setting

Eleven intensive therapy units and 22 acute care units of the elderly/general medical wards implemented the FIT in 13 English and Welsh hospitals. The FIT intervention was informed by behavioral theory, specifically goal setting,¹² control,¹³ and operant learning¹⁴ theories and used personalized goal setting and action planning to augment the effect of feedback. It involved a repeating 4-week audit cycle and was carried out by a designated member of staff, trained as a "ward coordinator." Notices were posted on each ward explaining that hand hygiene observations were being carried out and that any member of staff might be observed. In weeks 1 and 2, the ward coordinator covertly observed an individual HCW for 20 minutes. Immediate feedback was given to the individual directly after the period of observation. When the HCWs were noncompliant with hand hygiene, they were helped to formulate an individual goal and action plan to improve hand hygiene. Ward coordinators filled out a form recording observations, feedback, goals, and action plans and returned these to the FIT trial manager (C.F.). Details of the trial, the feedback forms, and the training given to ward coordinators in hand hygiene observation, feedback and helping HCWs set goals and action plans are available elsewhere (www.idrn.org/nosec.prp).¹⁵⁻¹⁷ Participants included HCWs on wards taking part in the FIT between September 2007 and August 2009.

Data collection

The feedback process included asking HCWs to explain their episodes of poor compliance and required the ward coordinators to document these "real-time" self-reported explanations of non-compliance on the feedback forms. This provided the current study, which was conducted after the conclusion of the trial, with a novel means of identifying self-reported barriers to hand hygiene that were linked in "real time" to an observed behavior.

Sample

In total, 570 feedback forms were returned, of which 209 indicated that hand hygiene had not been carried out. One hundred

eighty-five (89%) forms recorded 1 or more reasons given for not cleaning hands, of which 119 of 185 (64%) were from observations carried out on nurses, 19 of 185 (10%) from doctors, 35 of 185 (19%) from other HCWs (ie, professions allied to medicine and ancillary staff), and 12 (7%) from unrecorded staff groups. The forms were completed by a total of 52 ward coordinators (usually a junior sister/deputy ward manager) or infection control link nurse.

Analysis

Analysis was undertaken after the conclusion of the FIT trial. Formal standard operating procedures (available from the author) for the classification of responses into the 12 standardized behavioral domains (the Theory Domains Framework)⁵ were developed following discussion among the research team (C.F., S.B., J.S., J.M.). Explanations for noncompliance were then coded independently by 2 members of the FIT team (C.F. and S.B.). Disagreements were discussed, and any that were not resolved were discussed with a third researcher (J.S.) until consensus was reached. The percentage agreement between the 2 independent coders for all 185 forms was 85% (158/185). Of the 27 disagreements, 16 were agreed on discussion, 11 were resolved in consultation (with J.S.), and 3 were not resolved and coded as "Other."

Following this, 2 members of the FIT team (C.F. and S.B.) independently examined the data to identify themes that could further divide HCWs explanations within individual domains. Both researchers discussed each theme until consensus was reached as to which themes accurately reflected the data. A coding framework was developed (available from the author), and each explanation was coded independently. Disagreements in coding were discussed until agreement was reached.

RESULTS

In total, 185 forms recording noncompliance with hand hygiene guidelines were completed. Of these, 22 recorded more than 1 explanation for noncompliance and were coded to more than 1 theoretical domain, leading to a total of 207 domain codings. **Table 1** summarizes the numbers of explanations coded to each domain and theme, along with operational definitions and examples for each. All 207 explanations, broken down into their relevant domains and themes, are available from the author.

Three domains accounted for more than three-quarters of explanations (**Table 1**). The most commonly coded domain was "Memory/Attention/Decision Making" (87/207, 42%) followed by "Knowledge" (55/207, 26%) and then "Environmental Context/Resources" (18/207, 9%).

Separate themes were identified for 4 domains: "Memory/Attention/Decision Making," "Knowledge," "Environmental Context/Resources," and "Beliefs about Consequences."

Within the 'Memory/Attention/Decision Making' domain, 3 themes were identified (**Table 1**).

- (1) "Memory" (n = 40): Situations in which the HCW knew that hand hygiene should have been done but did not remember to do it.
- (2) "Awareness/concentration" (n = 29): Situations in which the HCW reported that they were unaware of their behavior or what they had done shortly before.
- (3) "Distraction" (n = 23): HCW distracted from doing hand hygiene by any sort of interruption. This theme was further subdivided into "non-urgent" tasks (n = 13) and "urgent" tasks (n = 10), "urgent" being defined as interruptions requiring immediate attention such as the patient being about to fall or

Table 1
Numbers (%) of self-reported explanations of noncompliance coded into each theoretical domain and theme with illustrative examples

Domain	Operational definition	Count, n = 207, n (%)	Themes*	Count	Examples
Memory/Attention/Decision Making	Forgetting to clean hands, concentration on/attention to another task, ie, being distracted by another non-urgent task, or making a conscious decision not to clean hands because another task is more urgent.	87 (42)	(1) Memory	40	"Forgot"
			(2) Awareness/concentration	29	"Preoccupied. Usually does comply."
			(3) Distraction/moving to another task: (a) "urgent" (n = 10) or (b) "non-urgent" (n = 13)	23	"... in a rush to give commode" "Thinking about other things needing doing ..."
Knowledge	Lack of knowledge of the rules, protocol or indications governing HH	55 (26)	(1) Specific indications: "glove use" (n = 18), "contact with patient" (n = 8), or "patient environment" (n = 17)	43	"Thought gloves were adequate" "Unaware hands to be cleaned after making beds"
			(2) Nonspecific indications	13	"Unaware of need"
Environmental Context/Resources	The role of environmental factors, ie, workload or lack of other resources in reducing the likelihood of performing HH	18 (9)	(1) Busy/workload	15	"Too busy" or "in a rush"
			(2) Lack of physical resources	4	"No moisturizer at bed space" "No handrub within reach"
Beliefs about Consequences	Perceived consequences of HH, ie, what are the costs/benefits to HCWs and patients	6 (3)	(1) Consequences to self (2) Consequences to patients	5 1	"Alcohol makes hands dry" "... did not see HH as a priority"
Nature of behavior	Noncompliance with HH because of habit	5 (2)	No separate themes identified	N/A	"Always forgets"
Skills	Absence of necessary practical skills and competencies to perform HH	2 (1)	No separate themes identified	N/A	"... out of practice"
Emotion	Emotions that interfere with HH	2 (1)	No separate themes identified	N/A	"... bad morning ..."
Social norms	The role of peers in influencing a HCW's HH	1 (<1)	No separate themes identified	N/A	"Conflicting instructions from staff members"
Other	Statements that did not fit into the framework domains [†] and those that had insufficient information	31 (15)	No separate themes identified	N/A	"Didn't know why" "Oh!" "Apologized"

HH, hand hygiene.

*In 7 cases, explanations for noncompliance could be coded to 1 domain but to more than 1 theme within that domain; hence, the number of themes coded is greater than the number of domain codings for "Memory/Attention/Decision Making," "Knowledge," and "Environmental Context/Resources."

[†]No explanations coded into the following domains: Professional Roles, Belief about Capabilities, Motivation/Intention, and Behavioral Regulation."

needing the toilet. None of the situations described as "urgent" included medical emergencies such as cardiac arrest.

Within the "Knowledge" domain, 2 themes were identified (Table 1), according to whether the recorded explanation mentioned a specific hand hygiene indication or not.

- (1) "Specific indication" (n = 43): Instances in which a particular indication for hand hygiene was mentioned, subdivided into the following:
 - (a) "Glove use" (n = 18): The HCW suggests that hand hygiene was not required because she/he was wearing gloves.
 - (b) "Patient contact" (n = 8): The HCW did not know that hand hygiene was required before/after/between patient contacts
 - (c) "Environmental contact" (n = 17): The HCW did not know that hand hygiene was required after contact with a potentially contaminated surface
- (2) "Nonspecific indication" (n = 13): The HCW mentions that she/he did not know that hands needed to be cleaned, but the specific indication for hand hygiene is not mentioned.

Two themes were identified within the "Environmental Context/Resources" domain (Table 1):

- (1) "Workload" (n = 15): The HCW reported that they were too busy or did not have the time to carry out hand hygiene.
- (2) "Lack of resources" (n = 4): Hand hygiene was not carried out because of lack of alcohol hand rub, soap, or other.

Only 6 responses were coded to the Beliefs about Consequences domain, 5 to the Nature of Behavior Domain, and only 1 or 2 to the Skills, Emotion, and Social Norms domains (see Table 1). No responses were coded to the Professional Roles, Beliefs about Capabilities, Motivation/Intention, and Behavioral Regulation domains.

A further 31 of 207 (15%) of responses did not fit into the framework, or researchers were not able to agree on how to code them. These responses were coded as "Other." The majority of responses were coded into this domain because they included statements that were not strictly speaking reasons for noncompliance, ie, "Apologized for not cleaning hands" or did not include enough information to allow coding, ie, "Changed gloves." In a further 3 cases, the researchers were not able to reach agreement on how to code the response. "Stated she felt she was not as good as normal." "Yes, can't remember." "Usually uses AHR then hand-washing when task is done."

DISCUSSION

Using a theory-based method of data coding, this study found that over three-quarters of self-reported explanations of HCWs' noncompliance with hand hygiene were linked to 3 behavioral domains: Memory/Attention/Decision Making (44%), Knowledge (26%), and Environmental Context/Resources (9%). Other behavioral domains were associated with only 8% of explanations, and 15% could not be coded to any domain.

One of the strengths of the study is that we collected "real-time" explanations for directly observed instances of noncompliance, a short time after they occurred. This is likely to generate more valid

data than studies investigating reasons for noncompliance long after the event because explanations are less likely to be influenced by factors such as forgetfulness. Additionally, we used a validated theoretical framework to map each explanation to behavioral domains with a high degree of agreement between coders. This is in contrast to other studies that used a single behavioral theory.

The study has 2 main potential limitations. Explanations provided by HCWs may be subject to a number of biases. For example, explanations may have been influenced by professional relationships between the observers and HCWs. Observations were made and explanations sought by senior members of staff on the ward, and there may, therefore, have been pressure to give “acceptable” responses, ie, social desirability bias. Thus, an alternative interpretation of the high number of explanations relating to memory and knowledge is that HCWs may have felt it more acceptable to provide these type of explanations (“I forgot,” and others) rather than explanations that may imply a lack of professionalism (“I couldn’t be bothered,” “I didn’t think it was important,” “I didn’t want to,” and others).

The second potential limitation is that observers may have misinterpreted HCWs’ explanations or diluted explanations. Although observers were trained to implement the intervention, including how to observe and record explanations,¹⁵ respondents’ explanations were not recorded verbatim because observers had limited space to write. Recorded explanations therefore tended to be short, lacking detail, and were sometimes ambiguous and difficult to code. Nonetheless, the fact that there were so many similarities in the explanations recorded, three-quarters of which could be coded to just 3 of the 12 behavioral domains, despite the large number of observers, indicates the training successfully standardized their approach to the task.

The findings of this study are consistent with those reporting that poor compliance with hand hygiene is linked to wearing gloves or situations perceived to be low risk for contamination^{18,19} or a heavy workload.²⁰ As far as the authors are aware, this is the first study to identify “Memory, Attention/Decision Making” and “Knowledge” as the 2 behavioral domains most commonly linked to noncompliance. This is in contrast to some previous studies that have identified poor access to hand hygiene facilities, social norms, or self-efficacy as key factors.²¹ The differences between our findings and those of other studies may reflect the different methods of data collection and behavioral analysis.

Thematic analysis within the “Memory/Attention/Decision Making” domain identified 3 themes: memory, awareness/concentration, and distraction, with “memory” being the most frequent. Explanations such as “I forgot” were common, with explanations including lack of attention to the task, poor concentration, and lack of awareness that they had either not cleaned their hands or had performed a task that required cleaning afterwards. Distraction was also common, and HCWs’ attention was often divided between tasks. This led, in some situations, to hand hygiene not being performed because staff were called away to a more urgent task (also reflected in the “heavy workload” theme identified within the Environmental Context domain).

Many interventions to improve hand hygiene have been based on the assumption that cleaning hands is a conscious, rational behavior. Our data, however, suggest that interventions should take into account the dynamic nature of the HCWs role, which can be characterized by multiple demands, requiring task prioritization, which in turn places strain on their attention. Future interventions could incorporate this by working with HCWs to develop “If-Then” plans, as was the case in the successful FIT trial,¹⁵ thus emphasizing automatic associative processes. “If-Then” plans take the form of “If situation X occurs then I will do Y.”²² Therefore, for instance, “if moving from one patient to another, then I will clean my hands

with alcohol hand rub.” These plans work by making it easier to detect the problem situation when encountered (the “IF” section of the plan) and, as a result of associative learning, to act on it (the “THEN” section).^{23,24}

Lack of knowledge featured as the second major reason for noncompliance, specifically in relation to the need for hand hygiene after touching environmental surfaces or when wearing gloves. The fact that HCWs reported confusion about when to clean hands despite the presence of widely available, simple guidelines, such as the WHO “5 moments for hand hygiene,”²⁵ suggests that staff training has not always been effective. An alternative explanation is that, although guidelines are simple and easy to learn, translating this into a working environment is more difficult. The movement of HCWs between tasks is complex, and correct identification of hand hygiene moments can be challenging.

Although our results suggest that there is still a need for focused training to upgrade knowledge specifically around appropriate glove usage and environmental contacts, systematic reviews^{2,3} suggest that educational interventions alone may not be effective. This is consistent with our findings that HCWs, who need to clean their hands many times a day, are subject to frequent distractions, so consistently remembering to clean hands is a challenge. Taken as a whole, our findings suggest that effective hand hygiene interventions should focus on targeting automatic and associative processes (working on “auto-pilot”) (such as IF-THEN plans) as well as ensuring good knowledge, thus enabling HCWs to identify indications for hand hygiene and to make the required hand hygiene a routine behavior.

This study was conducted across a wide geographic spread of hospitals, in a large number of wards, and a mixture of ward specialties, so may generalize to a wide range of settings. However, within these wards, hand hygiene was intensively promoted both as part of a trial to improve hand hygiene compliance and in the context of the successful national “cleanyourhands” campaign, which provided resources and support for hand hygiene.²⁶ For those HCWs working in areas without such campaigns, issues around lack of knowledge and resources may be more important than in our study wards. However, the participation of many countries in the WHO’s SAVE LIVES initiative, which offers a very similar multimodal hand hygiene campaign, makes generalizability more likely.

Future research using this study’s methodology should include extra training on interviewing techniques to improve the accuracy of recording and to facilitate recording of more detailed comments. Consideration should also be given to investigating the effect of different types of observer (for example, ward manager, peers, or audit personnel) on the explanations provided by HCWs. The methodology could also be extended to other patient safety behaviors and to different contexts and settings.

In conclusion, use of a theoretical framework to investigate HCW’s “real-time” explanations of noncompliance identified “Memory, Attention/Decision Making” and “Knowledge” as the 2 behavioral domains most commonly linked to noncompliance. This suggests that hand hygiene interventions should target both conscious decision making and automatic processes (working on “auto-pilot”) by, for example, using “If-Then” plans and ensuring good knowledge. Use of a theoretical framework to investigate HCW’s “real-time” explanations of noncompliance provides a coherent systematic way to inform the design of hand hygiene interventions.

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References

- World Health Organisation Global Patient Safety Challenge. 2005-2006/World Alliance for Patient Safety. Geneva: WHO; 2005.
- Naikoba S, Hayward A. The effectiveness of interventions aimed at increasing handwashing in healthcare workers: a systematic review. *J Hosp Infect* 2001; 47:173-80.
- Gould D, Moralejo D, Drey N, Chudleigh J. Methods to improve healthcare worker hand hygiene to decrease infection in hospitals. *Cochrane Syst Rev* 2010; CD005186.
- Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008;337:e1655.
- 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: Int Rev* 2008;57:660-80.
- Erasmus V, Daha TJ, Brug H, Richardus JH, Behrendt MD, Vos M, et al. Systematic review of studies on compliance with hand hygiene guidelines in hospital care. *Infect Control Hosp Epidemiol* 2010;31:283-94.
- Jenner E, Fletcher B, Watson P, Jones F, Miller L, Scott G. Discrepancy between self-reported and observed hand hygiene behaviour in healthcare professionals. *J Hosp Infect* 2006;63:418-22.
- Hunt DCE, Stone SP, Dacre J. Hand-hygiene behaviour, attitudes and beliefs in first year clinical medical students. *J Hosp Infect* 2005;59:371-3.
- Pessoa-Silva C, Posfay-Barbe K, Pfister R, Touveneau S, Pergener T, Pittet D. Attitudes and perceptions toward hand hygiene among healthcare workers caring for critically ill neonates. *Infect Control Hosp Epidemiol* 2005;26:305-11.
- Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A on behalf of the "Psychological Theory" group. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Qual Saf Health Care* 2005;14:26-33.
- Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Sci* 2012;7:37.
- Locke E, Latham GA. Theory of goal setting and task performance. Englewood Cliffs [NJ]: Prentice Hall; 1990.
- Carver CS, Scheier MF. On the structure of behavioural self-regulation. In: Boekaerts M, Pintrich PR, Zeidner M, editors. *Handbook of self-regulation*. Amsterdam: Academic Press; 2000.
- Skinner BF. *Science and human behaviour*. London: Macmillan; 1953.
- Fuller C, Michie S, Savage J, McAteer J, Besser S, Charlett A, et al. The Feedback Intervention Trial (FIT). Improving hand hygiene compliance in UK healthcare workers: a stepped wedge cluster randomised controlled trial. *PLoS ONE* 2012; 7:e41617.
- McAteer J, Stone S, Fuller C, Charlett A, Cookson B, Slade R, et al. Development of an observational measure of healthcare worker hand hygiene behaviour: the hand hygiene observation tool (HHOT). *J Hosp Infect* 2008;68:222-9.
- Fuller C, Besser S, Cookson B, Fragaszy E, Gardiner J, McAteer J, et al. Assessment of blinding of hand hygiene observers in randomised controlled trials of hand hygiene interventions. *Am J Infect Control* 2010;38:332-4.
- Raboud J, Saskin R, Wong K, Moore C, Parucha G, Bennett J, et al. Patterns of handwashing behavior and visits to patients on a general medical ward of healthcare workers. *Infect Control Hosp Epidemiol* 2004;25:198-202.
- Fuller C, Savage J, Besser S, Hayward A, Cookson B, Cooper B, et al. "The dirty hand in the latex glove": a study of hand hygiene compliance when gloves are worn. *Infect Control Hosp Epidemiol* 2011;32:1194-9.
- Pittet D, Mourouga P, Perneger TV. Compliance with handwashing in a teaching hospital. *Ann Intern Med* 1999;130:126-30.
- De Wandel D, Maes L, Labeau S, Vereecken C, Blot S. Behavioural components of hand hygiene compliance in intensive care units. *Am J Crit Care* 2010;19:230-9.
- Gollwitzer PM, Sheeran P. Implementation intentions and goal achievement: a meta-analysis of effects and processes. *Adv Exp Social Psychol* 2006;38:69-119.
- Gollwitzer PM. Implementation intentions: strong effects of simple plans. *Am Psychol* 1999;54:493-503.
- Webb T, Sheeran P. Identifying good opportunities to act: implementation intentions and cue discrimination. *Eur J Social Psychol* 2004;34:407-19.
- World Health Organization. WHO guidelines on hand hygiene in health care. Geneva: WHO; 2009.
- Stone SP, Fuller C, Savage J, Cookson BD, Hayward A, Cooper B, et al. An evaluation of the national cleanyourhands campaign, an initiative to reduce *Staphylococcus aureus* bacteraemia and *Clostridium difficile* infection in hospitals in England and Wales through improved hand hygiene: a four year prospective ecological interrupted time-series study. *BMJ* 2012;344:e3005.