American Journal of Infection Control 47 (2019) 798–803

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

The influence of observational hand hygiene auditing on consultant doctors' hand hygiene behaviors: A qualitative study

Maura P. Smiddy PhD [a,*], Olive M. Murphy MB BCh BAO, FRCPI, FFPath [b], Eileen Savage PhD [c], John P. Browne PhD [a]

[a] School of Public Health, University College Cork, Cork, Ireland
[b] Infection Prevention and Control Team, Bon Secours Hospital, Cork, Ireland
[c] Catherine McCauley School of Nursing and Midwifery, University College Cork, Cork, Ireland

Key Words:
Audit
Compliance
Doctor
Theoretical Domains Framework
Feedback
Behavior

Background: Compliance with hand hygiene guidelines reduces the risk of health care–associated infection, yet doctors are less compliant than other health care workers. Use of observational hand hygiene auditing with targeted individualized feedback was implemented, with improved hand hygiene of consultant doctors; however, the factors that influenced this were not explained by previous quantitative data. The aim was to explore consultant doctors' opinions about the influence of observational hand hygiene auditing with individualized feedback on hand hygiene behavior.

Methods: Using the Theoretical Domains Framework, we conducted 12 semi-structured in-depth interviews with consultant doctors who experienced the observational hand hygiene audit and feedback intervention. Data were analyzed using a thematic analysis approach.

Results: Analysis identified 8 domains of the Theoretical Domains Framework, with 5 dominant domains: (1) behavioral regulation: receiving written individualized audit feedback positively influenced practice; (2) knowledge: provision of specific individualized feedback improved performance; (3) reinforcement: audit highlighted substandard practices; (4) social professional role and identity: audit reports triggered profession-associated competitive motivation; and (5) environmental context and resources: auditing was perceived to be synonymous with strong organizational safety culture.

Conclusions: In this study, provision of individualized targeted feedback was a critical component of observational hand hygiene auditing.

Health care–associated infections affect an estimated 10% of hospitalized patients.[1] These infections increase morbidity, mortality, and subsequent costs to health care providers.[2,3] Hand hygiene is integral to infection prevention and is one of the top 10 strategies that can be implemented to improve patient safety.[4] The "5 moments for hand hygiene" guidelines from the World Health Organization (WHO) are implemented internationally as the standard for best practice.[5] The WHO multimodal approach includes observational hand hygiene auditing (OHHA) as part of the quality improvement strategy.[6] This approach has been shown to improve hand hygiene compliance.[7,8]

Although hand hygiene is an effective intervention in the prevention of health care–associated infections,[9] optimal compliance is elusive.[10] Reported compliance varies among professional disciplines and is higher in nurses than in doctors.[11] Information is an important influencer of behavior, and audit with timely feedback of findings can enable compliance with hand hygiene guidelines.[12] In the broader quality improvement literature, certain feedback characteristics, such as the provision of individualized reports, are associated with a greater likelihood of positive behavior change.[13] Health care workers acknowledge the value of hand hygiene auditing,[14] yet poor timeliness of feedback and lack of specificity in relation to the clinical area and discipline are reported as barriers to efficacy.[15]

Currently, common OHHA and feedback practices consist largely of provision of cumulative multidisciplinary reports. Increased compliance rates have been reported in which audit has been incorporated in hand

* Address correspondence to Maura Smiddy, PhD, Epidemiology and Public Health, School of Public Health, University College Cork, Western Gateway Bldg, Western Rd, Cork, Ireland.
E-mail address: m.smiddy@ucc.ie (M.P. Smiddy).

Conflicts of interest: None to report.

Ethics approval and consent to participate: The study was approved by the relevant ethics committee.

https://doi.org/10.1016/j.ajic.2018.12.024

hygiene improvement campaigns.[16,17] Yet there are challenges related to OHHA, including provision of trained auditors, bias in collecting and reporting data, and the threat to validity due to the Hawthorne effect.[18,19]

Interventions intended to change health care worker behavior should be supported with evidence-based theoretical models.[20] A growing body of literature focuses on the value and use of psychological theory and behavior change techniques for improving hand hygiene performance.[21,22] The Theoretical Domains Framework (TDF) is a validated, integrated theoretical approach, synthesized from multiple psychological theories, aimed at providing a logical context to support implementation of change in health care.[23,24] The Framework, consisting of 14 domains, provides a focus for intervention implementation, research, and evaluation. This theoretical approach has been used effectively to plan hand hygiene interventions and to explore factors and beliefs that influence compliance.[22,24]

OHHA with cumulative feedback regarding all categories of staff was implemented at the study site in a 345-bed acute care hospital in Ireland in 2011. Reports were provided in hard copy to departments and as an annual report from the infection prevention and control (IPC) team. Observational audit of orthopedic surgeons' hand hygiene performance with individualized feedback was initiated in 2012. This was implemented in response to an increased rate of surgical site infection and observed suboptimal hand hygiene performance. Hand hygiene compliance improved among this group, and the initiative was then extended to all other consultant doctors within the organization (N = 61). Auditing was implemented by clinical nurse managers during clinical rounds, and with the support of the IPC team, reports were e-mailed to each consultant with their individual score of observed compliance and anonymized compliance scores of all other consultants. Compliance rates among consultant doctors increased annually after the introduction of auditing with individualized feedback: 79% in 2012 (95% confidence interval [CI], 77, 81), 85% in 2013 (CI, 84, 86), 90% in 2014 (CI, 89, 91), and 94% in 2015 (CI, 93, 95).

Although audit and feedback have been demonstrated to improve performance, the impact of consistent individualized audit feedback on hand hygiene performance needs further exploration. The purpose of this qualitative study was to use the TDF to explore consultant doctors' opinions about the influence of OHHA with individualized feedback on hand hygiene behavior.

METHODS

Design and setting

This study incorporated the TDF to guide in-depth semi-structured interviews with consultant doctors who had participated in an individualized OHHA with feedback intervention. This study was part of a mixed methods sequential explanatory design,[25] in which the quantitative data prompted and informed the qualitative research. Interviews lasted between 30 and 45 minutes and took place between May and October 2017. This study took place in a 345-bed acute care hospital in Ireland.

Sampling and recruitment

Interviews were conducted with 12 consultant doctors. Consultant doctors were identified using the hospital Web site, and purposive sampling[26] was carried out with the support of the IPC team. Consultant doctors were categorized at the outset into 3 groups according to their level of compliance with the WHO guidelines. Groups were defined as early adaptors (conformed quickly, within 1 month), early majority (conformed within 2 months of audit and individualized feedback), and laggards (those who, in spite of individualized audit and feedback, had the least conformity with hand hygiene practices).[27] The interviewer was not informed which category of compliance each participant was allocated to; however, participants from each group were interviewed.

Data collection

A semi-structured topic guide based on the TDF[24] was used to structure data collection (Appendix A). The topic guide and interview process were piloted with 1 consultant doctor, resulting in minor adaptations. The interviews were conducted face-to-face by 1 researcher (M.S.) either in the hospital or in the doctors' consulting rooms. Written informed consent was obtained from participants prior to interview. No additional emerging themes were noted after 11 interviews, and data collection was stopped after the 12th.[28] Interviews were digitally recorded and transcribed verbatim. NVivo 11 qualitative data management software (QSR International, Melbourne, Australia) was used to facilitate data storage, organization, and analysis. The interviewer (M.S.) was an IPC nurse manager who had previously worked at the study site. Therefore, reflexivity involved consideration of possible influences on participant responses owing to the interviewer's professional background. However, the interviewer had not worked in a professional capacity in the organization since 2010, and the TDF guided the interview process, data collection, and analysis, thereby reducing the impact of the researcher's prior knowledge and experience.

Analysis

Transcripts were analyzed using a thematic analysis approach involving coding, identification of emergent themes, and mapping of themes to the appropriate theoretical domain.[22] All transcripts

Table 1
TDF domains and relevant themes

TDF domains	Themes
Dominant domains	
Behavioral regulation	■ Triggering effect of audit and individualized feedback ■ Audit identifies substandard practice
Knowledge	■ Poor knowledge and recall of cumulative observational hand hygiene reports ■ Specific individualized feedback targets knowledge deficit ■ Incomplete knowledge regarding the "5 moments for hand hygiene" prevented doctors from complying with best practice
Reinforcement	■ Substandard practices need to be addressed at a senior level
Environmental context and resources	■ Efficacy of hand hygiene improvement interventions is linked to organizational culture and resources
Social professional role and identity	■ Audit results stimulate professional competitiveness, influencing motivation and performance ■ Audit reports are valuable for professional development and provide evidence of good practice
Other relevant domains	
Belief about consequences	■ Doctors identified with their personal accountability in the prevention of HCAI and patient safety
Memory, attention, and decision processes	■ Auditing and availability of resources trigger improved compliance with hand hygiene
Social influences	■ Behavior of other health care professionals and patient expectations influence hand hygiene practice

HCAI, health care–associated infection; *TDF*, Theoretical Domains Framework.

were coded by 1 researcher (M.S.), and a subset was independently analyzed and coded by E.S. to verify and validate the initial analysis. Agreements on coding were reached through discussion and consensus.

RESULTS

In total, 12 consultant doctors were interviewed: 9 men and 3 women. Consultant clinical specialties were medical (n = 8)—oncology (n = 2), rheumatology (n = 2), gastroenterology (n = 2), cardiology (n = 1), and dermatology (n = 1)—and surgical (n = 4)—ear, nose, and throat (n = 1); urology (n = 1); orthopedics (n = 1); and general surgery (n = 1). The analysis identified 8 domains of the TDF as relevant to 12 emerging themes (Table 1). The findings are presented as a thematic model in Figure 1.

Behavioral regulation

Doctors consistently identified that audit and individualized feedback improved their hand hygiene compliance and performance. Feedback through personal reports increased their awareness of not performing as well as they had presumed, resulting in action planning and motivating practice change. Implementation of targeted auditing by clinical nurse managers during clinical ward rounds appeared to have minimized the impact of the Hawthorne effect.[18] Doctors did not feel that the presence of auditors influenced their hand hygiene practice during ward rounds. They commented that discontinuing the provision of individualized feedback would adversely affect hand hygiene practice both in themselves and in new medical staff, leading to reduced compliance (Table 2). They also stated that stopping individualized reports, which acted as self-monitoring tools, would adversely impact hand hygiene practice, leading to reduced compliance (Table 2).

Knowledge

A lack of knowledge regarding cumulative multidisciplinary group observational hand hygiene reports received prior to individualized reports was evident. Doctors indicated that the provision of specific individualized feedback increased hand hygiene knowledge and improved performance. They did not always know what they were doing wrong in relation to their hand hygiene practice. Lack of awareness was thought to prevent doctors from complying with best practice. This was associated with the "5 moments for hand hygiene." Participants stated that this lack of knowledge led to poorer audit results and indicated that hand hygiene education was one of the most influential factors for their practice (Table 2).

Reinforcement

The doctors stated that substandard practices must be addressed by senior staff and the organization, highlighting the need for reinforcement. Doc``tors' views varied regarding the management of consultant staff with poor hand hygiene compliance. Some believed

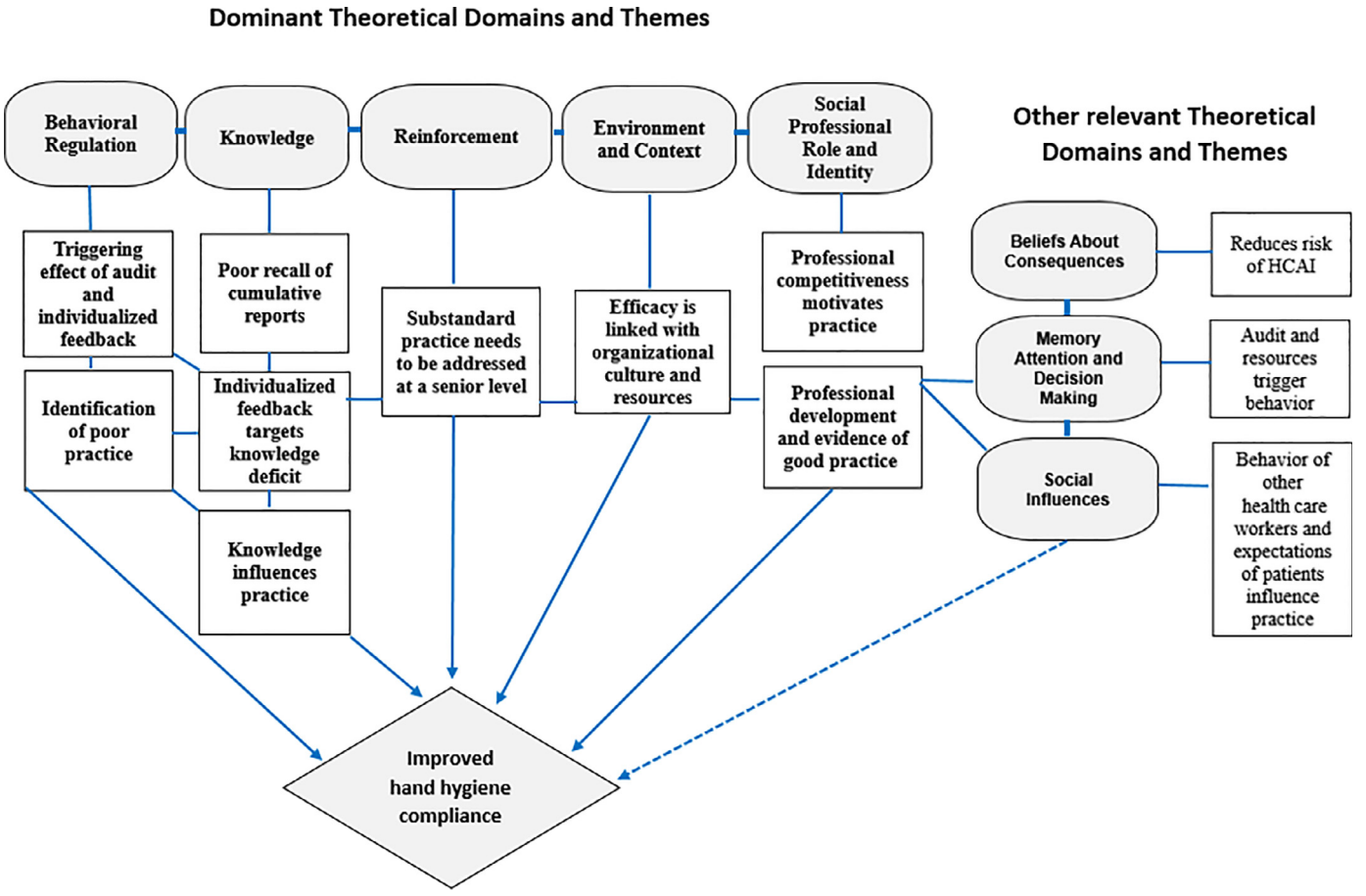

Fig 1. Thematic model of theoretical domains influencing consultant doctors' hand hygiene dominant domains and themes. *HCAI*, health care–associated infection.

Table 2
TDF domains and quotes

TDF Domains	Quotes
Dominant Domains and Themes	
Behavioral Regulation	"It takes individualized feedback to indicate that maybe you are not perfect, or there are areas that you are missing" (Participant 1).
	"There is no doubt that the fact that observational hand hygiene audit stimulates you to be more conscious of it (hand hygiene), in that you don't really want to get a report saying that you are at 60% compliance. That does help to keep awareness and motivation up" (Participant 4).
	"I'm not conscious of somebody standing watching me when I'm doing it [hand hygiene], maybe I'm too self-absorbed or concentrating on the patient. I never really notice people doing it" (Participant 10).
	"I think people would go back . . . it would have a negative effect" (Participant 12).
Knowledge	"I can't remember when it changed to individualized. If you said to me it was always individualized, I would have said, 'Right, okay,' because it's been individualized as long as I can remember" (Participant 6).
	"I think I did poorly in my first report. Honestly, I got my first report, I thought, "I don't remember not washing my hands" . . . I actually asked about this and they said, "Well you shook the patient's hand", I said, "That's not touching. . .." So, there was a learning process in it for me"" (Participant 5).
Reinforcement	"That would be a discipline issue. I think if you thought that one of your colleagues was walking around with dirty hands when everybody else was making a huge effort to keep the things [hands] clean. We have them [alcohol-based hand rub dispensers] outside every door, they're in every room, they are almost on every bed. What else can you do? At some point, somebody's going to have to stand up and manage the hospital" (Participant 7).
	"People scoring less than 80% on their hand hygiene audit will have their . . . In America, what they did was, you lost your car parking privileges, then you lost your prescribing rights, or you lost your admission privileges" (Participant 3).
	"I don't think it should be punitive because I actually think you never change practice by actually beating someone up . . . physically, emotionally or financially. You don't" (Participant 11).
Environment context and resources	"Two things [that influenced hand hygiene practice], one would be the cultural change and secondly would be the easy availability of the stuff [alcohol-based hand rub]" (Participant 8).
	"It is important that we are seen to be hygienic also, so it's important for the patients, and also the nursing staff and the ancillary staff to see that this is a thoughtful, careful hospital that is ultimately developing with the patients in their [the patients] best interest" (Participant 5).
	"The alcohol thing [alcohol based hand rub] every ten feet around the ward has made a big difference." (Participant 8).
Social professional role and identity	"Medics, by and large, are quite competitive and you would like to see your scores being good" (Participant 2).
	"They get the reports, so they probably see it [compliance levels] and I think that's good, that should continue, because I think if you see all your colleagues doing their bit that would actually influence me. Certainly, I'd want to try and improve my practice" (Participant 9).
	"I write down . . . I participate in hand hygiene audits and so do the hospital" (Participant 11).
	"The first thing, if I was a lawyer, it would be go to ask do they do handwashing, could I see the individuals and if they scored poorly then the patient has a huge case there that they can actually say they've consistently not been demonstrated to be complying" (Participant 11).
Other Relevant Domains and Themes	
Belief about consequences	"Ultimately, it's for patient health and patient wellbeing; that's the primary reason" (Participant 5).
Memory, attention and decision processes	"I can't think of any other triggers. The feedback would be the single most important thing" (Participant 4).
	"Having plenty of dispensers; the sight of the dispenser is a reminder" (Participant 1).
Social Influences	"The fact that everyone is scrubbing up and everybody is doing it, there is a herd mentality in relation to this. If everybody's doing it, we all do it" (Participant 2).
	"The visibility in doing it, as in . . . engenders more confidence [in patients], that you think hand hygiene is important" (Participant 11).

TDF, Theoretical Domains Framework.

there should be punitive consequences for nonconformers; however, others felt this would be unhelpful (Table 2).

Environmental context and resources

Efficacy of OHHA interventions was believed to be associated with a positive organizational safety culture and widespread availability of resources. When participants were asked what most influenced their practice, both organizational culture and availability of resources were cited as important factors. Ease of availability of hand hygiene resources within the clinical environment triggered hand hygiene. This is linked closely to the TDF domain "memory, attention, and decision-making" (Table 2).

Social professional role and identity

Doctors stated that audit triggered competitiveness, which they viewed as characteristic of the medical profession wanting to demonstrate good practice. This competitive need for improvement led to both internal and external motivation. Some doctors stated they disliked their own suboptimal performance, which motivated practice change. It was claimed that peer influence was important not just in terms of avoiding failure or being competitive but also in terms of taking collective responsibility for improving practice. Some doctors stated they believed that the individualized audit reports were valuable for both professional development and legal protection. It was believed that these reports could be useful should litigation arise (Table 2). The remaining domains of the TDF—that is, "belief about consequences"; "memory, attention, and decision processes"; and "social influences"—were less evident in the data, although some evidence of each emerged (Table 2).

Once data analysis was completed, categorization of interviewees by their level of observed compliance[27] was discussed and considered. There were no patterns between participant interview data and their observed level of conformance with hand hygiene guidelines.[5]

DISCUSSION

Audit and prompt individualized feedback provided consultant doctors with personal data to inform their actions, allowing them to break poor hand hygiene compliance habits. The success of targeted doctor hand hygiene reports has been reported previously[29]; however, the reasons for behavior change were not explored. Recall of previous reports that provided data for each department or ward or by staff category was poor in this study. Cumulative multidisciplinary reporting did not provide specific feedback for individual behavior change.[15] Exploration of feedback as a component in evaluation of audit efficacy has been identified.[30] This study outlines the importance of individualized audit feedback and how it influenced doctors' behavioral change.

Doctors largely agreed that individualized reports provided knowledge to address areas of nonconformance they had not previously identified, addressing the theory-practice gap. They did not identify with the concept of missed "moments for hand hygiene" until they received feedback and were educated about specific "missed moments." Timely individualized feedback has been associated with adherence to guidelines.[13] Reduced compliance has been reported in audit and feedback programs in which feedback was discontinued.[31] In view of the amount of time and manpower needed to implement and report generic multidisciplinary hand hygiene audit results, efficacy of cumulative reporting needs to be assessed further.[32]

The need to appropriately manage persistent noncompliance was highlighted in this study. However, approaches to addressing poor practices varied with reference to punitive and nonpunitive methods. Management of noncompliant staff is also dependent on the structure of the health care organization and employment conditions. It has been proposed that noncompliance with hand hygiene guidelines be considered a patient safety error with possible disciplinary outcomes.[15] This is supported by the view that although clinical care cannot be provided in which there is a culture of individualized blame, personal accountability for actions must be pursued when there is evidence of ongoing nonconformance and disregard for ratified policies.[33]

Involvement of hospital management and senior staff is essential for creating a culture of patient safety.[34] Participants in this study spoke of a strong culture of patient safety and hand hygiene in the organization. This is closely linked to a sense of organizational expectance of each health care worker's accountability for their own practice. Although the value of organizational commitment was demonstrated by the participants when they spoke about the positive feeling of needing to conform and create a safe environment for patients, this needs to be consistent with ease of availability of hand hygiene resources.[35] Accessible hand hygiene resources also acted as a trigger for reminding doctors to decontaminate their hands.

A sense of competition among doctors regarding hand hygiene audit reports instigated intrinsic and extrinsic motivation. The sense of "mini humiliation" (participant 5) and the desire to have good scores motivated improved hand hygiene performance. Personal achievement, professional pride, and positive clinical outcomes influenced intrinsic motivation.[36] Participation in OHHA was viewed as a positive factor that could be used to contribute to evidence of continuous professional development and good clinical practice. The negative effect of poor conformance among senior medical staff and peers has been reported.[37] However, this study demonstrated the positive effect of good hand hygiene behaviors of other health care workers. Doctors' compliance with hand hygiene was influenced by what they perceived patients expected of them and a desire to demonstrate good practices.

A key strength of this study is that it is underpinned by the TDF in evaluating the targeted OHHA and feedback intervention. By making the key theoretical domains explicit, it was possible to identify factors that seemed most influential in improving hand hygiene. This information will inform policy and decision-making. There are some limitations to this study, as the aim was to evaluate a targeted audit and feedback intervention. The sample size was also small and limited to a single study site. There was, in addition, the risk of response bias by participants that could have been influenced by a desire to provide the "correct response."

CONCLUSIONS

This research provides an important insight into the value of OHHA and individualized feedback in a targeted group. This was a small study at a single site. However, the element of individualized feedback was essential to audit efficacy in improving practice, with poor recall of cumulative multidisciplinary reports. In an era when IPC resources are limited, with competing interests, such as surveillance and control of antimicrobial resistance, consideration needs to be given to how OHHA is best used as a quality improvement tool. Although improvements have been documented, more focus needs to be paid to less conformant groups and how IPC resources are most effectively managed to improve patient safety.

Acknowledgments

We would like to thank the consultant doctors for their participation and the IPC team for their assistance and support.

References

1. World Health Organization. Health care without avoidable infections. The critical role of infection prevention and control 2016. Available from: http://www.who.int/infection-prevention/publications/ipc-role/en/. Accessed January 29, 2018.
2. Burke JP. Infection control—a problem for patient safety. N Engl J Med 2003;348:651-6.
3. Jenks PJ, Laurent M, McQuarry S, Watkins R. Clinical and economic burden of surgical site infection (SSI) and predicted financial consequences of elimination of SSI from an English hospital. J Hosp Infect 2014;86:24-33.
4. Shekelle PG, Pronovost PJ, Wachter RM, McDonald KM, Schoelles K, Dy SM, et al. The top patient safety strategies that can be encouraged for adoption now. Ann Intern Med 2013;158:365-8.
5. World Health Organization. WHO guidelines on hand hygiene in healthcare 2009. Available from: http://www.who.int/gpsc/5may/tools/9789241597906/en/. Accessed January 29, 2018.
6. World Health Organization. A guide to the implementation of the WHO multimodal hand hygiene improvement strategy 2009. Available from: http://apps.who.int/iris/handle/10665/70030. Accessed January 29, 2018.
7. Luangasanatip N, Hongsuwan M, Limmathurotsakul D, Lubell Y, Lee AS, Harbarth S, et al. Comparative efficacy of interventions to promote hand hygiene in hospital: systematic review and network meta-analysis. BMJ 2015;351:h3728.
8. Kingston L, O'Connell NH, Dunne CP. Hand hygiene-related clinical trials reported since 2010: a systematic review. J Hosp Infect 2016;92:309-20.
9. Allegranzi B, Pittet D. Role of hand hygiene in healthcare-associated infection prevention. J Hosp Infect 2009;73:305-15.
10. Erasmus VM, Brouwer WM, van Beeck EF, Oenema A, Daha TJ, Richardus J, 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;30:415-9.
11. Azim S, Juergens C, McLaws ML. An average hand hygiene day for nurses and physicians: the burden is not equal. Am J Infect Control 2016;44:777-81.
12. Smiddy MP, O'Connell R, Creedon SA. Systematic qualitative literature review of health care workers' compliance with hand hygiene guidelines. Am J Infect Control 2015;43:269-74.
13. Hysong SJ, Best RG, Pugh JA. Audit and feedback and clinical practice guideline adherence: making feedback actionable. Implement Sci 2006;1:9.
14. Jang JH, Wu S, Kirzner D, Moore C, Youssef G, Tong A, et al. Focus group study of hand hygiene practice among healthcare workers in a teaching hospital in Toronto, Canada. Infect Control Hosp Epidemiol 2010;31:144-50.
15. McInnes E, Phillips R, Middleton S, Gould D. A qualitative study of senior hospital managers' views on current and innovative strategies to improve hand hygiene. BMC Infect Dis 2014;14:611.
16. Stone SP, Fuller C, Savage J, Cookson B, Hayward A, Cooper B, et al. Evaluation of the national Cleanyourhands campaign to reduce *Staphylococcus aureus* bacteraemia and *Clostridium difficile* infection in hospitals in England and Wales by improved hand hygiene: four year, prospective, ecological, interrupted time series study. BMJ 2012;344:e3005.
17. Reichardt C, Königer D, Bunte-Schönberger K, van der Linden P, Mönch N, Schwab F, et al. Three years of national hand hygiene campaign in Germany: what are the key conclusions for clinical practice? J Hosp Infect 2013;83(Suppl):11-6.
18. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. J Clin Epidemiol 2014;67:267-77.
19. Neo JR. Construct validity—current issues and recommendations for future hand hygiene research. Am J Infect Control 2017;45:521-7.
20. Davidoff F, Dixon-Woods M, Leviton L, Michie S. Demystifying theory and its use in improvement. BMJ Qual Saf 2015;24:228-38.
21. Huis A, van Achterberg T, de Bruin M, Grol R, Schoonhoven L, Hulscher M, et al. A systematic review of hand hygiene improvement strategies: a behavioral approach. Implement Sci 2012;7:92-105.
22. Squires J, Linklater S, Grimshaw J, Graham I, Sullivan K, Bruce N, et al. Understanding practice: factors that influence physician hand hygiene compliance. Infect Control Hosp Epidemiol 2014;35:1511-20.
23. Francis JJ, O'Connor D, Curran J. Theories of behavior change synthesized into a set of theoretical groupings: introducing a thematic series on the Theoretical Domains Framework. Implement Sci 2012;7:35.

24. Cane J, O'Connor D, Michie S. Validation of the Theoretical Domains Framework for use in behavior change and implementation research. Implement Sci 2012;7:37.
25. Creswell JW. Designing and conducting mixed methods research. 2nd ed. London (United Kingdom): Sage; 2011.
26. Patton M. Qualitative research & evaluation methods. 3rd ed. London (United Kingdom): Sage; 2002.
27. Rogers EM. Diffusion of innovations. NewYork (NY): Simon & Schuster; 2010.
28. Lincoln YS, Guba EG. Naturalistic inquiry. London (United Kingdom): Sage; 1985.
29. Reich JA, Goodstein ME, Callahan SE, Callahan KM, Crossley LW, Doron S, et al. Physician report cards and rankings yield long-lasting hand hygiene compliance exceeding 90%. Crit Care 2015;19:1-6.
30. Ivers NM, Sales A, Colquhoun H, Michie S, Foy R, Francis JJ, et al. No more 'business as usual' with audit and feedback interventions: towards an agenda for a reinvigorated intervention. Implement Sci 2014;9:14.
31. Gerber JS, Prasad PA, Fiks AG, Localio R, Bell LM, Keren R, et al. Durability of benefits of an outpatient antimicrobial stewardship intervention after discontinuation of audit and feedback. JAMA 2014;312:2569-70.
32. Slater K, Cooke M, Rickard C, Whitby M. Can hand hygiene observation and reporting be improved through a risk-based targeted approach? Am J Infect Control 2017;45:212-3.
33. Wachter RM, Pronovost PJ. Balancing "no blame" with accountability in patient safety. N Engl J Med 2009;361:1401-6.
34. Zingg W, Holmes A, Dettenkofer M, Goetting T, Secci F, Clack L, et al. Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus. Lancet Infect Dis 2015;15:212-24.
35. Birnbach DJ, Nevo I, Scheinman SR, Fitzpatrick M, Shekhter I, Lombard JL, et al. Patient safety begins with proper planning: a quantitative method to improve hospital design. Qual Saf Health Care 2010;19:462-5.
36. Cassel CK, Jain SH. Assessing individual physician performance: does measurement suppress motivation? JAMA 2012;307:2595-6.
37. Lankford MG, Zembower TR, Trick WE, Hacek DM, Noskin GA, Peterson LR, et al. Influence of role models and hospital design on the hand hygiene of health-care workers. Emerg Infect Dis 2003;9:217-23.

APPENDIX A. SEMI-STRUCTURED INTERVIEW GUIDE

Introductory questions:

- OHHA commenced in the hospital in 2010. Do you have any recollection of audit reports prior to receiving your individual ones?
- What were the motivational factors that influenced your behavior in complying with hand hygiene guidelines?

TDF domains	Question prompts	Comments
Knowledge	• HH guidelines impact on practice? • Any HH education (undergrad/postgrad/consultant)? • HH and HCAI? • Use of OHHA?	
Beliefs about consequences	• Effect of HH on your patients? • Impact on practice?	
Skills	• How confident are you regarding how and when to perform HH?	
Beliefs about capabilities	• Difficulties? • What would help to improve your HH?	
Intention	• Need to improve HH compliance? • Circumstances that influence you to miss/comply more with opportunities? • What would make HH easier?	
Goals	• Personal priorities re HH/infection? • Personal or group action plan for reducing HCAI?	
Memory, attention, and decision	• Routinely or occasionally need to remind yourself? Influencing factors? • Are there triggers/reminders that help? • How does the knowledge you are being audited affect your performance?	
Emotion and optimism	• Feelings regarding HH or OHHA? • Considered how OHHA makes you feel? • How did you feel when you received individualized audit feedback? (Reflection on practice?) • How likely do you think improved compliance with HH will continue if OHHA is discontinued?	
Environmental context and resources	• Influence of resources? • How had OHHA influenced your practice prior to individualized feedback? After? • If you did not receive individualized reports, how would that influence your practice? • How would you feel about your individualized HH audit reports being sent to the CEO? • Discussed at management team? • Culture of HH within the organization?	
Social influences	• Team members influence your performance? • Patients' expectations influence your performance? • Self-perception as a role model for others?	
Social professional role	• Patient consultations? • Practice compared with peers?	
Behavioral regulation	• In your opinion, what steps do you think should be taken to improve HH at the individual and organizational level?	
Reinforcement	• What has most influenced your HH practice? • How have your views on HH changed since the introduction of OHHA? • Thoughts going forward re HH/OHHA?	

CEO, chief executive officer; *HCAI*, health care–associated infection; *HH*, hand hygiene; *OHHA*, observational hand hygiene auditing; *postgrad*, postgraduate; *re*, regarding; *TDF*, Theoretical Domains Framework; *undergrad*, undergraduate.