



Provided by the author(s) and University of Galway in accordance with publisher policies. Please cite the published version when available.

Title	A toolkit for improving hand hygiene compliance in intensive care
Author(s)	Lambe, Kathryn; Lydon, Sinéad; McSharry, Jenny; Byrne, Molly; Squires, Janet; Power, Michael; Domegan, Christine; O'Connor, Paul
Publication Date	2020-10-15
Publication Information	Lambe, Kathryn, Lydon, Sinéad, McSharry, Jenny, Byrne, Molly, Squires, Janet, Power, Michael, Domegan, Christine, O'Connor, Paul. (2020). A toolkit for improving hand hygiene compliance in intensive care. Galway: National University of Ireland Galway. doi:10.13025/ydyd-an87
Publisher	National University of Ireland Galway
Link to publisher's version	https://doi.org/10.13025/ydyd-an87
Item record	http://hdl.handle.net/10379/16192
DOI	http://dx.doi.org/10.13025/ydyd-an87

Downloaded 2024-05-18T02:44:42Z

Some rights reserved. For more information, please see the item record link above.





OÉ Gaillimh
NUI Galway



A toolkit to improve hand hygiene compliance in intensive care



Executive Summary

This toolkit is based upon research completed as part of the Health Research Board (HRB) funded project: 'A Moment for Hand Hygiene in the Intensive Care Unit: How Can Compliance Be Improved?' The purpose of this toolkit is to provide guidance to Intensive Care Unit (ICU) staff on how to:

- choose a suitable intervention for improving hand hygiene (HH) compliance in their unit;
- implement the intervention; and
- assess whether the intervention has been effective.

Although this toolkit is specifically tailored towards improving hand hygiene compliance in the ICU, it is also relevant for improving compliance in any healthcare setting.

Healthcare-associated infections present a serious challenge to safe, effective, and efficient healthcare, and are of particular concern in the intensive care unit (ICU), with prevalence rates of 20% to 30% reported. Good infection control practices, including hand hygiene, have been identified as being crucial to the safe performance of intensive care procedures, and are the primary means of reducing HAI prevalence and safeguarding vulnerable ICU patients.

Despite the importance of compliance with hand hygiene guidelines, there is evidence internationally that compliance is suboptimal, and the research evidence to support and guide the implementation of interventions to improve hand hygiene compliance is weak. This means that decisions regarding hand hygiene improvement are made in the absence of scientific consensus on best or effective practice.

The purpose of the toolkit developed within this research programme, and described in this report, is to provide guidance to ICU staff on how to choose a suitable intervention for improving hand hygiene compliance in their unit, implement the intervention, and assess whether the intervention has been effective.

The toolkit provides background on hand hygiene compliance, presents a model of behavioural change, and then uses an established quality improvement framework (Plan Do Study Act) to guide the implementation of an appropriate hand hygiene intervention strategy. The toolkit describes 21 possible interventions, derived from the research literature and expert consensus, and provides guidance on the sorts of problems they may be able to address in ICU.

Kathryn Lambe^{1,2}
Sinéad Lydon^{1,2}
Molly Byrne³
Jenny McSharry³
Janet Squires^{4,5}
Michael Power⁶
Christine Domegan⁷
Paul O'Connor*^{1,2}

Affiliations:

- 1 School of Medicine, National University of Ireland Galway, Co. Galway, Ireland
- 2 Irish Centre for Applied Patient Safety and Simulation, School of Medicine, National University of Ireland Galway, Co. Galway, Ireland
- 3 Health Behaviour Change Research Group, School of Psychology, National University of Ireland Galway, Co. Galway, Ireland
- 4 The Ottawa Hospital Research Institute, Ottawa, ON, Canada
- 5 Faculty of Health Sciences, University of Ottawa, Ottawa, ON, Canada
- 6 National Clinical Programme for Critical Care, Clinical Strategy & Programmes Division, Health Service Executive, Dublin, Ireland
- 7 J.E. Cairnes School of Business and Economics, National University of Ireland Galway, Co. Galway, Ireland

* Corresponding Author: Dr Paul O'Connor, Discipline of Primary Care, NUI Galway. E: paul.oconnor@nuigalway.ie

Published October 2020

To reference, please cite: Lambe, K., Lydon, S., McSharry, J., Byrne, M., Squires, J., Power, M., Domegan, C. & O'Connor, P. (2020). A toolkit to improve hand hygiene compliance in intensive care. Galway: NUI Galway. DOI:10.13025/ydyd-an87

Contents

Executive Summary	1	9. Stage 3 – Study	34
1. Aims of the toolkit	4	9.1 Insight about outcomes	35
2. Background	6	9.2 Unintended consequences	35
2.1 Hand hygiene compliance	7	10. Stage 4 – Act	36
2.2 Improving hand hygiene compliance	8	10.1 The intervention was effective	37
2.3 The Irish context	8	10.2 The intervention was ineffective	37
3. Model of behaviour change	11	10.3 Aspects of the intervention were effective, but it did not completely have the desired effect	37
3.1 The COM-B model	12	11. Conclusions	38
3.2 The Theoretical Domains Framework	13	12. Acknowledgments	38
3.3 Intervention function	14	Appendix 1. A Moment for Hand Hygiene – Project outcomes	40
4. Identifying an appropriate hand hygiene intervention	15	A1.1 Project summary and findings	41
5. Quality Improvement and the Plan-Do-Study-Act cycle	17	A1.2 Published papers	42
6. Using the hand hygiene toolkit within a PDSA cycle for improvement	19	Appendix 2. Physical environment checklist	43
7. Stage 1 - Plan	21	Appendix 3. Sample staff hand hygiene interview schedule	44
7.1 Establishing a team	22	Appendix 4. Sample coded staff hand hygiene interview and Theoretical Domains coding framework	45
7.2 Diagnosis: Identifying the issues	22	A4.1 Theoretical Domains coding framework	45
7.3 Identifying the appropriate intervention	24	A4.2 Sample coded interview	46
8. Stage 2 - Do	32	Appendix 5. Hand hygiene attitudes questionnaire and scoring information	47
8.1 Baseline measurements	33	Appendix 6. Intervention descriptions	48
8.2 Establish buy-in	33		
8.3 Monitor the process	33		

1

Aims of the toolkit

1. Aims of the toolkit

The purpose of this toolkit is to provide guidance to Intensive Care Unit (ICU) staff on how to:

- **choose a suitable intervention for improving hand hygiene (HH) compliance in their unit;**
- **implement the intervention; and**
- **assess whether the intervention has been effective.**

Although this toolkit is specifically tailored towards improving hand hygiene compliance in the ICU, it is also relevant for improving compliance in any healthcare setting.

This toolkit is based upon research completed as part of the Health Research Board (HRB) funded project: 'A Moment for Hand Hygiene in the Intensive Care Unit: How Can Compliance Be Improved?'¹ (see Appendix 1 for a summary of the findings of this project).

This document describes the toolkit but also provides background on hand hygiene compliance, presents the model of behavioural change which underpins the toolkit, and is centred on a quality improvement framework so as to facilitate the implementation of an appropriate hand hygiene intervention strategy.

2

Background

2. Background

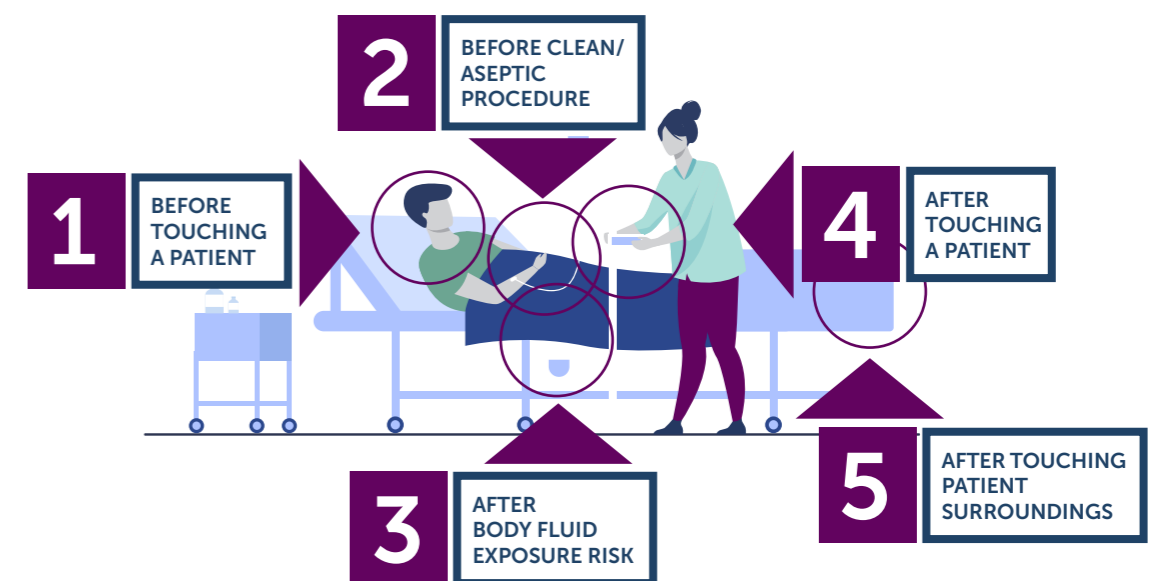
2.1 Hand hygiene compliance

Healthcare-associated infections (HAIs) present serious challenges to the delivery of safe, effective, and efficient healthcare. HAIs affect 4% of patients worldwide and account for almost 100,000 deaths annually in the United States.² HAIs are of particular concern in the ICU, where prevalence rates between 20% and 30% have been reported.³ Good infection control practices, including hand hygiene, have been identified as being crucial to the safe performance of intensive care procedures,^{4,5} and are crucial to safeguard vulnerable patients. Improvement in hand hygiene practices

has been highlighted as the most effective safeguard against HAIs, and the World Health Organisation's (WHO) guidelines, published in 2009, have been widely adopted.⁶ A foundational element of the WHO guidelines is the "five moments of hand hygiene", which prompts healthcare workers (HCWs) to clean their hands at five specific moments during patient care (see Figure 1).⁷

However, compliance with the five moments of hand hygiene in the ICU is lower than desirable. A 2019 systematic review of 61 international studies found that, on average, ICU staff were compliant on only 59.6% of hand hygiene moments when observed.⁸

Figure 1. The Five Moments of Hand Hygiene (World Health Organisation, 2009)



- ¹ 'A Moment for Hand Hygiene in the Intensive Care Unit: How Can Compliance Be Improved?' Health Research Board Grant Number HRA-HSR-2015-1071. Principal Investigator: O'Connor, P. Co-investigators, Byrne, M., Domegan, C., McSharry, J., Power, M., & Squires, J.
- ² Magill, S.S., Edwards, J.R., Bamberg, W., Beldavs, Z.G., Dumyati, G., Kainer, M. A., et al. Antimicrobial Use Prevalence Survey, T. (2014). Multistate point-prevalence survey of health care-associated infections. *New England Journal of Medicine*, 370(13), 1198-1208. <https://doi.org/10.1056/NEJMoa1306801>
- ³ Klevens, R.M., Edwards, J.R., Richards, C.L., Horan, T.C., Gaynes, R.P., Pollock, D.A., et al. (2007). Estimating health care-associated infections and deaths in US hospitals, 2002. *Public Health Reports*, 122, 160-166.
- ⁴ Reddy, K., Byrne, D., Breen, D., Lydon, S., & O'Connor, P. (2020). The application of human reliability analysis to three critical care procedures. *Reliability Engineering and System Safety*. <https://doi.org/10.1016/j.ress.2020.107116>
- ⁵ Lavelle, A., White, M., Griffiths, M., Byrne, D., & O'Connor, P. (2020). Human reliability analysis of bronchoscope assisted percutaneous dilatational tracheostomy: implications for simulation based education [Manuscript submitted for publication].
- ⁶ Mathai, E., Allegranzi, B., Kilpatrick, C., Bagheri Nejad, S., Graafmans, W., & Pittet, D. (2011). Promoting hand hygiene in healthcare through national/subnational campaigns. *Journal of Hospital Infection*, 77(4), 294-298.
- ⁷ World Health Organization (2009). *WHO Guidelines on Hand Hygiene in Health Care*. Geneva, Switzerland.
- ⁸ Lambe, K.A., Lydon, S., Madden, C., Vellinga, A., Hehir, A., Walsh, M., et al. (2019). Hand hygiene compliance in the intensive care unit: A systematic review. *Critical Care Medicine*, 47(9):1251-1257.

2.2 Improving hand hygiene compliance

Despite the importance of hand hygiene, and a clear need to increase compliance in ICU settings, there are serious and fundamental weaknesses in the research evidence to guide the implementation of hand hygiene interventions.^{9,10}

- *Lack of methodological rigour.* There is a lack of methodologically robust studies to explore the effectiveness of interventions to increase hand hygiene compliance.
- *Lack of a theoretical basis for intervention.* Hand hygiene interventions commonly fail to have a theoretical basis to support the implementation of evidence into practice.
- *Lack of practical guidance in how to apply, and sustain, good hand hygiene practices.* There are few descriptions of concrete and practical strategies to improve hand hygiene practice in ICUs.
- *Inadequate understanding of the complexities of the environment and organisation in which the behaviour is to take place.* Changes in an organisation require the consideration of a range of factors interacting at different levels of an organisation.

These weaknesses mean that decisions regarding hand hygiene improvement are made in the absence of scientific consensus. Best practice for improving compliance, therefore, remains unestablished.¹¹ Accordingly, in the absence of rigorous

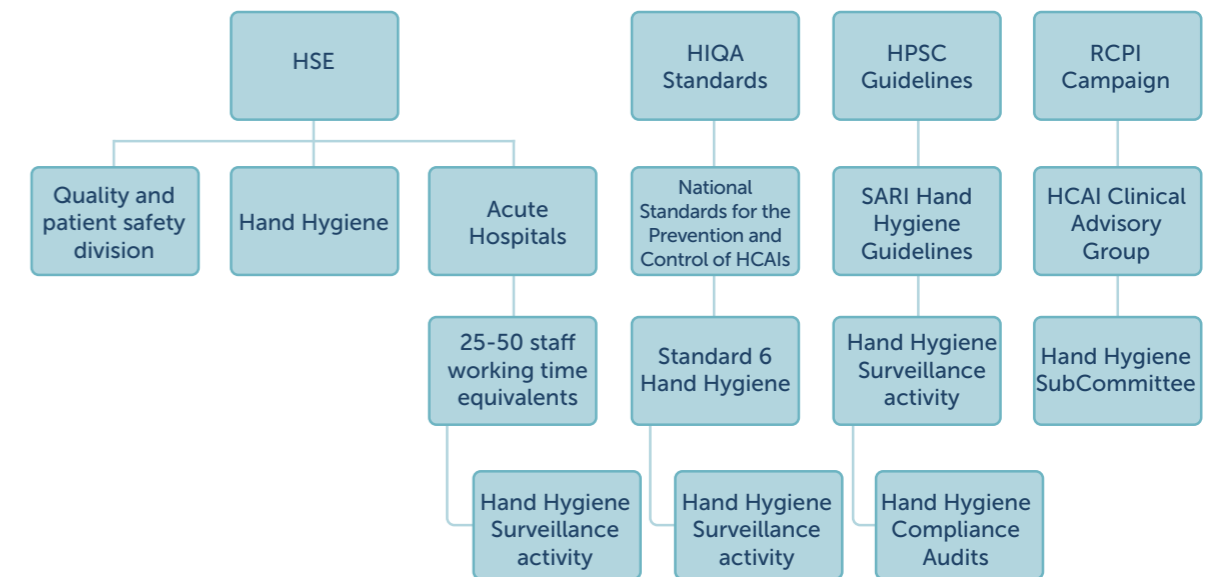
evidence for a particular intervention, this toolkit uses the best available evidence that does exist in the literature. This evidence is supported by input from researchers, policy makers, ICU staff, and members of the public in order to identify a range of interventions that may be effective in a particular ICU.

2.3 The Irish context

In Ireland, preventing HAIs has been identified as a system-wide priority area of the Health Services National Service Plan.¹² There are a number of organisations involved in hand hygiene regulation, enforcement, and training in Ireland. The Department of Health, Health Information and Quality Authority (HIQA), Royal College of Physicians in Ireland (RCPI), Health Service Executive (HSE), and the Health Protection Surveillance Centre (HPSC) have respective policy, regulatory, expert advisory, operational and monitoring and surveillance roles in various aspects of hand hygiene in the Irish healthcare system (see Figure 2).

The coordination of the activities of these agencies has resulted in some positive effects. For example, Ireland was the first European country to have a national hand hygiene policy. However, the disconnect between perceived hand hygiene practices in the actual clinical environment (i.e., the micro-level) and the regulatory perspective (i.e., the macro-level) has the potential to lead to uncertainty as to the governance of hand hygiene within the Irish health service.

Figure 2. Organogram of hand hygiene governance, delivery and resource in the Irish healthcare system



Further, although HSE-conducted audits have found very high levels of hand hygiene compliance, with a majority of acute hospitals reporting compliance above the HSE target of 90%,¹³ observations of hand hygiene opportunities (n= 712) in three ICUs and one High Dependency Unit (HDU) in Ireland, carried out as part of the research to support the development of this toolkit, identified a mean hand hygiene compliance of 56.9% across staff and settings.¹⁴ This research also found that although ICU staff in Ireland generally believe they have the knowledge of when and how to carry out hand hygiene appropriately, they tend to overestimate levels of compliance.¹⁵

The difference between the levels of hand hygiene compliance in the research study as compared to HSE audit may be explained by considering the different purposes of the audits, and differences in how the data was collected. Goodhart's Law states that 'when a measure becomes a target,

it ceases to be a good measure'. In other words, when a specific goal for hand hygiene compliance is established (e.g., achieve 90% compliance in hand hygiene audits), people will be motivated to achieve this goal during the audit. This is likely to be particularly true if failing to achieve 90% compliance can lead to negative outcomes for the unit and the hospital.

Therefore, while the audit is being carried out (generally limited to observations of 30 hand hygiene opportunities per unit), HCWs are able to achieve the target of 90% hand hygiene compliance. However, in the hand hygiene compliance research project there were no targets for hand hygiene compliance, and the HCWs were observed over multiple shifts across five days. Therefore, arguably, the levels of compliance found in the research project may be a closer reflection of actual practice than the audit findings.

⁹ Lydon, S., Power, M., McSharry, J., Byrne, M., Madden, C., Squires, J. E., et al. (2017). Interventions to improve hand hygiene compliance in the ICU: A systematic review. *Critical Care Medicine*, 45(11), e1165-e1172.

¹⁰ Drey, N., Gould, D., Purrssel, E., Chudleigh, J., Moralejo, D., et al. (2020). Applying thematic synthesis to interpretation and commentary in epidemiological studies: Identifying what contributes to successful interventions to promote hand hygiene in patient care. *BMJ Quality and Safety*, 29: 756-63.

¹¹ Lydon, S., Power, M., McSharry, J., Byrne, M., Madden, C., Squires, J. E., et al. (2017). Interventions to improve hand hygiene compliance in the ICU: A systematic review. *Critical Care Medicine*, 45(11), e1165-e1172.

¹² Health Service Executive. (2012). *National Service Plan 2012*. <https://www.hse.ie/eng/services/publications/corporate/nsp2012.pdf>. Accessed 10 November 2017.

¹³ Health Protection Surveillance Centre. (2020). *Period 18 (Oct/Dec 2019) Hand Hygiene Compliance Results*. [https://www.hpsc.ie/az/microbiologyantimicrobialresistance/europeansurveillanceofantimicrobialconsumptionesac/PublicMicroB/hand hygieneA/hand hygieneA_Current.pdf](https://www.hpsc.ie/az/microbiologyantimicrobialresistance/europeansurveillanceofantimicrobialconsumptionesac/PublicMicroB/hand%20hygieneA/hand%20hygieneA_Current.pdf). Accessed 4 June 2020.

¹⁴ Madden, C., Lydon, S., Walsh, C., O'Dowd, E., Fox, S., Lambe, K., et al. (in press). What are the predictors of hand hygiene compliance in the Intensive Care Unit? A cross-sectional observational study. *Journal of Hospital Infection*.

¹⁵ Lydon, S., Grealley, C., Tujjar, O., Reddy, K., Lambe, K., Madden, C., et al. (2019). Psychometric evaluation of a measure of factors influencing hand hygiene behaviour to inform intervention. *Journal of Hospital Infection*, 102(4):407-412.

There exist a number of Irish national-level policies and guidelines relevant to hand hygiene in the ICU (e.g., '*National standards for the prevention and control of healthcare associated infections*', '*Guidelines for hand hygiene in Irish healthcare settings*'). However, the analysis of these documents found that they are brief, with little guidance on how hand hygiene compliance should be improved. Further, interviews with Irish hand hygiene policy makers and stakeholders (n=12) about improving hand hygiene compliance found that these individuals emphasised the need for ongoing training in hand hygiene, as well as the importance of social factors (e.g., modelling of correct hand hygiene behaviours by seniors) in encouraging compliance. Policy makers were

also sceptical of the impact of protocols on real-world hand hygiene practice.¹⁶ This is consistent with the opinions of Irish ICU staff. Interviews with 26 ICU staff¹⁷ working in Ireland indicated that the staff felt that they receive frequent education on hand hygiene and that the physical supplies they need to perform hand hygiene are reliably available. The ICU staff also noted the potential impact of social environment and that the presence of role models for hand hygiene exerts significant influence on compliance.

In Ireland, preventing HAIs have been identified as a system-wide priority area of the Health Services National Service Plan.

3

Model of behaviour change

¹⁶ Madden, C., Lydon, S., Lambe, K., & O'Connor, P. (2019). Irish policy-makers' perceptions of barriers and facilitators to hand hygiene compliance. *Irish Medical Journal*, 112(4), 914.

¹⁷ Lambe, K., Lydon, S., Madden, C., McSharry, J., Marshall, R., Boylan, R., et al. (2020). Understanding hand hygiene behaviour in the intensive care unit to inform interventions: an interview study. *BMC Health Services Research*, 20(1), 353.

3. Model of behaviour change

3.1 The COM-B model

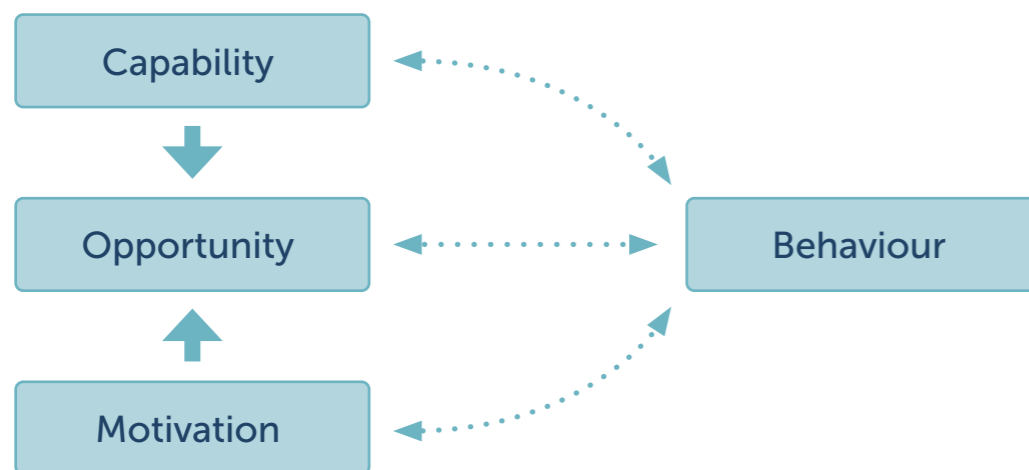
It has been stated that the reason that many interventions that are designed to change behaviours, such as hand hygiene compliance, fail to have the desired effect is because they are not based upon a theory of behaviour change. Theories of behaviour change are particularly important in considering how to improve hand hygiene compliance as these theories can help local teams to understand the hand hygiene behaviour they observe in their units. Interventions can then be tailored to the specific needs of that particular unit.

A commonly applied approach to consider how to change behaviour is the COM-B model (see Figure 3).¹⁸ This model posits that behaviour (B) results from the interaction of a person’s capability (C), opportunity (O) and motivation (M) to engage in it.

- Capability encompasses both physical capability (physical skills, strength, or stamina) and psychological capability (knowledge, psychological skills, strength or stamina).
- Opportunity refers to the features of the environment that allow or facilitate the behaviour, including the physical environment (e.g., equipment, location) and the social environment (e.g., social cues, interpersonal influences, cultural norms).
- Motivation includes both reflective (deliberate planning and evaluation) and automatic aspects (habits, emotional reactions, impulses, reflex responses).

These three components of the COM-B model can interact. For example, a healthcare worker may be motivated to wash their hands but lack the opportunity to do so due to a lack of sinks, or lack the capability to do so properly due to a lack of training. In this way, the COM-B model is particularly useful for identifying barriers and facilitators for a given behaviour.

Figure 3. The COM-B model (adapted from Michie et al¹⁷)



¹⁸ Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science*, 6, 42. <https://doi.org/10.1186/1748-5908-6-42>

3.2 The Theoretical Domains Framework

A related and complementary framework to the COM-B model is the Theoretical Domains Framework.¹⁹ This is a comprehensive framework that offers more explanation and detail on the variables within each of the COM-B dimensions, such as the factors that contribute to or

determine an individual’s capability of engaging in a behaviour (i.e., knowledge, physical skills, etc.). The Theoretical Domains Framework is specifically designed to support decision-making about which interventions should be used. This framework identifies 14 different domains, divided across the three COM-B dimensions, that influence behaviour (see Table 1).²⁰

Table 1. The Theoretical Domains Framework (adapted from Michie et al¹⁹)

COM-B Dimensions	Theoretical Domains Framework
Capability	<ol style="list-style-type: none"> 1. Knowledge- an awareness of the existence of something. 2. Physical skills- an ability or proficiency acquired through practice. 3. Memory, attention and decision processes- the ability to retain information, focus selectively on aspects of the environment and choose between alternatives. 4. Behavioural regulation- anything aimed at managing or changing observed or measured actions.
Opportunity	<ol style="list-style-type: none"> 5. Environmental context and resources- any circumstance of a person’s situation or environment that discourages the development of skills and abilities, independence, social competence and adaptive behaviour. 6. Social influences- those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours.
Motivation	<ol style="list-style-type: none"> 7. Professional/social role and identity- a coherent set of behaviours and displayed personal qualities of an individual in a social or work setting. 8. Beliefs about capabilities- acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to use. 9. Optimism-the confidence that things will happen for the best or that desired goals will be attained. 10. Beliefs about consequence- acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation. 11. Intentions- a conscious decision to perform a behaviour or a resolve to act in a certain way. 12. Goals- mental representations of outcomes or end states that an individual wants to achieve. 13. Reinforcement- increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus. 14. Emotion- a complex reaction pattern, involving experiential, behavioural, and physiological elements.

¹⁹ Michie, S., Atkins, L., & West, R. (2014). *The behaviour change wheel: A guide to designing interventions*. London: Silverback Publishing.

²⁰ Atkins, L., Francis, J., Islam, R., O’Connor, D., Patey, A., Ivers, N., et al. (2017). A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation Science*, 12(1), 77.

3.3 Intervention function

In addition to the consideration of the domains that influence behaviour, it is also necessary to consider the function of any planned intervention, i.e. what the intervention is supposed to do. The framework associated with the COM-B model describes nine possible functions²¹:

1. **Coercion:** creating an expectation of punishment or cost.
2. **Education:** increasing knowledge
3. **Training:** increasing skills.
4. **Enablement:** increasing means or reducing barriers to increase capability, or opportunity.
5. **Environmental restructuring:** changing the physical or social context.
6. **Incentivisation:** creating an expectation of reward.
7. **Modelling:** providing an example for people to aspire to or imitate.
8. **Persuasion:** using communication to induce positive or negative feelings or stimulate action.
9. **Restriction:** using rules to reduce the opportunity to engage in the target behaviour.

The COM-B model, and the associated theoretical domain framework and intervention functions, has informed the research on which this toolkit is based, and the identification and selection of interventions for improving hand hygiene that will be described in the next sections.

4

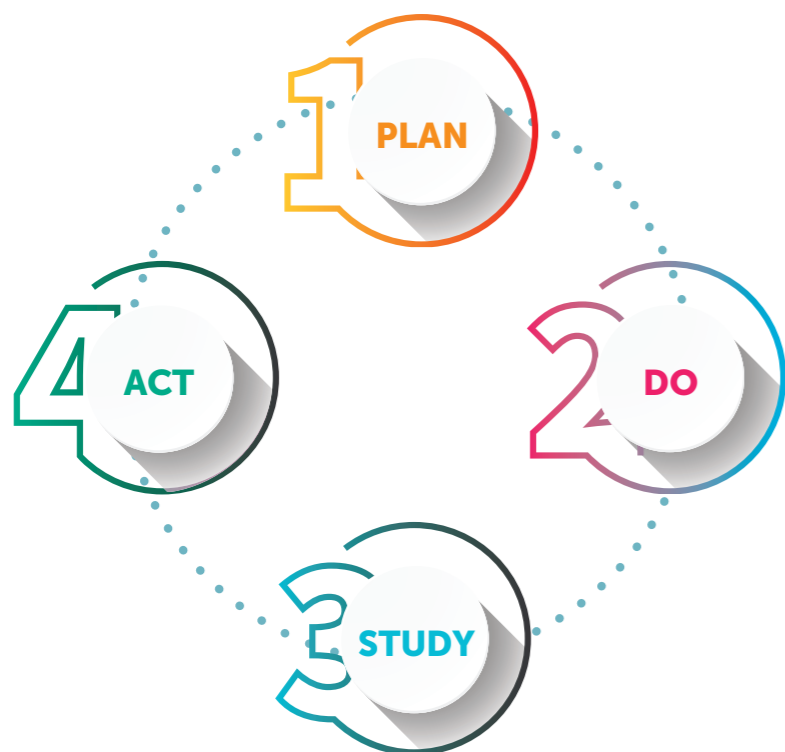
Identifying an appropriate hand hygiene intervention

²¹ Michie, S., Atkins, L., & West, R. (2014). *The behaviour change wheel: A guide to designing interventions*. London: Silverback Publishing.

4. Identifying an appropriate hand hygiene intervention

The remaining sections of this toolkit will explain how to step through the process of identifying the barriers to hand hygiene compliance, the selection of an intervention to address these barriers, the implementation of the intervention, and assessing whether the intervention has improved hand hygiene compliance. There are many models of Quality Improvement (QI). However, this toolkit draws upon the 'Plan-Do-Study-Act' (PDSA) cycle model. These four cycles align with the experimental method of developing a hypothesis (plan),

implementing an intervention or change to effect an outcome (do), collecting data to test the effects of the change on the outcome (study) and analysing the data in order to make inferences to allow change to be made to the hypothesis (act).²² This model of QI enables rapid assessment of an intervention and provides flexibility to quickly make changes based upon feedback. The PDSA model provides a roadmap for the process of choosing, planning, implementing and evaluating an intervention for hand hygiene improvement. Importantly, the PDSA model is likely to be familiar to staff working clinically and those with responsibility for quality improvement efforts in their organisation.



5

Identifying an appropriate hand hygiene intervention

²² Taylor MJ, McNicholas C, Nicolay C, et al. (2014). Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ Quality & Safety*;23:290–8.

5. Quality Improvement and the Plan-Do-Study-Act cycle

We often have intuitive ideas about what changes might improve a situation in the workplace, and how to help people engage in behaviours that we think will be of benefit. However, when targeted changes in behaviour relate to patient safety, it is important that we take action on the basis of the best available evidence, test changes before rolling them out widely within an organisation, and have a clear goal for what we want to achieve. The PDSA model is a useful framework used for Quality Improvement for thinking about this process.²³

The PDSA model begins with three key questions:

1. What are we trying to accomplish?

State the improvements you want to see in detail, with measurable targets. For example, if the goal is to improve compliance with WHO hand hygiene moments 1 and 5 (before and after contact with the patient or their surroundings), the measurable target may be to improve compliance with these moments to 75% across all shifts within four weeks.

2. How will we know if the change is an improvement? What measures of success will we use?

Outcomes can be assessed using a range of approaches. For example, the primary outcome of interest, hand hygiene compliance, can be measured using through observation and audit. Alternatively, brief staff interviews can help to determine whether the specific changes made really worked as intended. A number of potential measures are described later in the guide under 'Plan'.

3. What changes can we make that will result in improvement?

Numerous changes could be made that may improve hand hygiene compliance. The purpose of the toolkit is to help you to decide which interventions are appropriate for your unit. Direction on selecting interventions is provided later in the document in the 'Do' section.

6

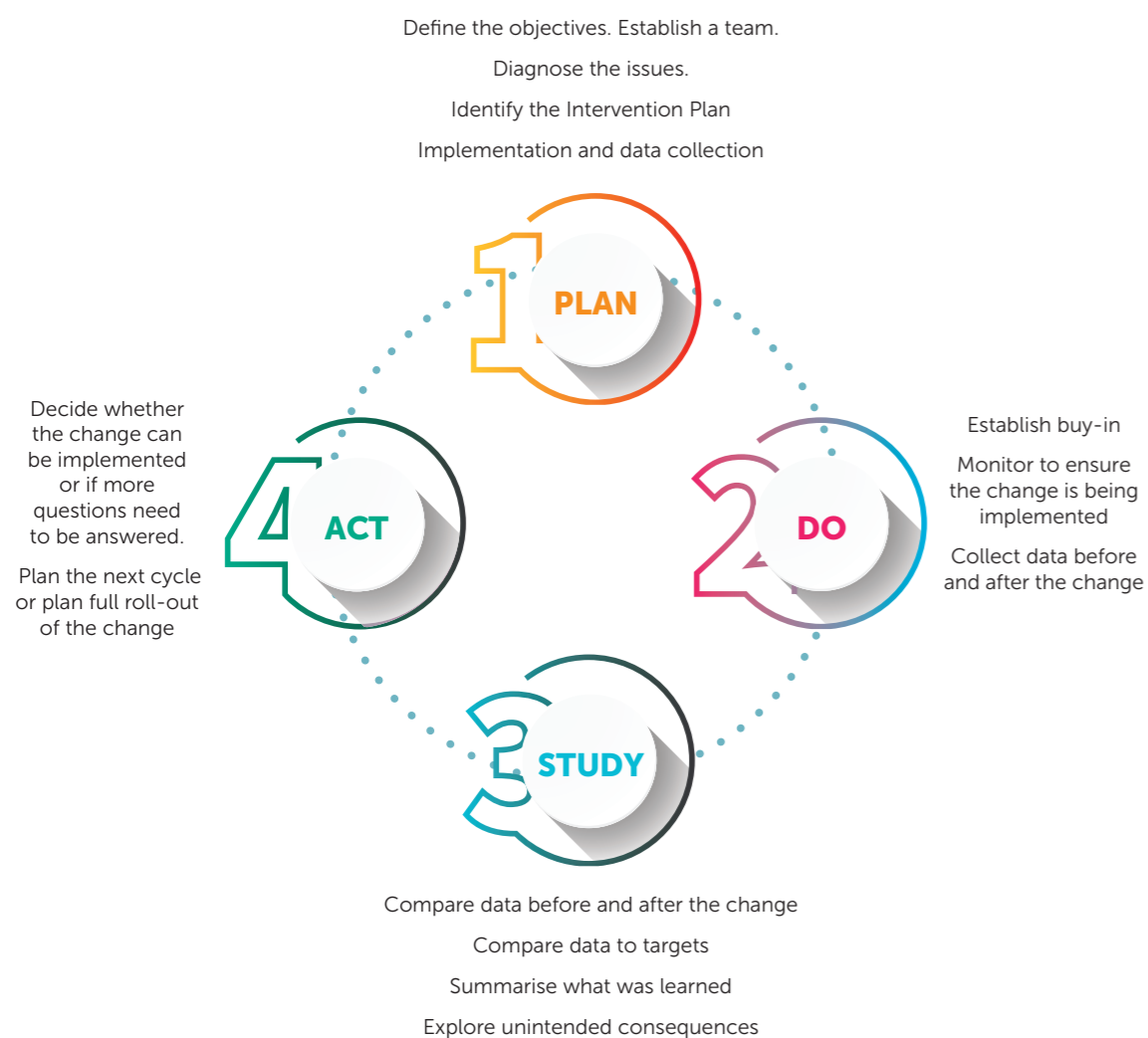
Using the hand hygiene toolkit within a PDSA cycle for improvement

²³ O'Connor, P. (2020). ASPIH conference 2019 keynote paper. Quality improvement through simulation: a missed opportunity? *BMJ Simulation and Technology Enhanced Learning*, 6:193-195.

6. Using the hand hygiene toolkit within a PDSA cycle for improvement

Once the key questions outlined above have been clearly answered, the four stages of the PDSA model can be followed as shown in Figure 4. The following sections will provide guidance on how to use a PDSA cycle to support the selection, application, and assessment of a suitable hand hygiene intervention.

Figure 4. The Plan Do Study Act model (adapted from ACT Academy NHS Improvement²⁴)



²⁴ ACT Academy, NHS Improvement (Producer). (2018). Plan, Do, Study Act (PDSA) cycles and the model for improvement. Retrieved from <https://improvement.nhs.uk/documents/2142/plan-do-study-act.pdf>. Accessed 4 June 2020.

7

Stage 1 - Plan

7. Stage 1 - Plan

7.1 Establishing a team

Hand hygiene is the responsibility of everyone in a healthcare organisation, and all can play a role in supporting initiatives to improve compliance. Securing buy-in from all stakeholders (i.e., HCWs, management, policy makers, patients, etc.) is critical. When assembling a team to develop the intervention, consider involving representatives from some or all of the following groups:

- leaders and authority figures within each professional group (nurses, intensivists, anaesthetists, therapists, porters, catering staff, cleaning staff, healthcare assistants), who will be impacted, or targeted, by the intervention;
- administrative staff, to provide support for appropriate and efficient record-keeping, purchasing and other key tasks;
- research staff within the hospital or any affiliated university, who can provide support and advice on data collection and analysis;
- management and policy makers, who can secure financial resources and support for the project; and
- hand hygiene trainers, who can provide necessary education and training for frontline staff and auditors.

7.2 Diagnosis: Identifying the issues

Each ICU has a combination of strengths and challenges and a unique culture, all of which must be taken into consideration when deciding what to do to improve hand hygiene compliance. We recommend the following four methods for gathering information about hand hygiene compliance at a local level, so that the team can understand the current level of

compliance and how staff on the ground feel about hand hygiene. None of these methods provides sufficient information on their own to identify an appropriate intervention. However, combining some or all of these methods provides a rich, comprehensive picture of the barriers to hand hygiene compliance in a particular unit.

- 1. Observations** - objective, valid measurement of hand hygiene behaviour in real practice, including compliance with each of the WHO five moments of hand hygiene.
- 2. Unit checklist** - assessment of the physical environment and features that support or inhibit hand hygiene compliance.
- 3. Interviews** - exploration with staff members of their attitudes to hand hygiene and factors that support or inhibit compliance, in their own words.
- 4. Hand hygiene attitudes questionnaire** - quantitative information on staff attitudes to hand hygiene, including their self-reported compliance with each of the WHO five moments.

Each of these methods of these methods is described in more detail below.

7.2.1 Observations

Direct observation is widely regarded as the 'gold standard' method for measuring hand hygiene compliance. Observation allows the identification of:

- 1.** whether there are particular hand hygiene moments that need to be targeted for improvement in an intervention,
- 2.** whether there are particular groups of healthcare professionals that should be targeted in an intervention, and
- 3.** whether there are particular times of day that should be targeted in an intervention.

It is important that those carrying out the observations have been trained and know how to use the WHO observation method. Observation should be made of different HCWs across different shifts. Comprehensive guidance and resources are available from the HSE.²⁵ One concern is that the person being observed may modify their hand hygiene behaviour when they know that they are being studied (known as the Hawthorne effect).²⁶ This is particularly the case when a small number of observations are being carried out, and if the findings will be reported outside the unit as part of an audit. It is therefore suggested that, as far as possible, attempts should be made to minimise the effect of observation on hand hygiene behaviours. This could be achieved by conducting unit-level observations and assuring the staff that the purpose is to identify how hand hygiene can be improved, as opposed to for audit or to assess staff members individually. Finally, it is important to observe all five moments of hand hygiene, something that is not always done. Compliance has been shown to be significantly higher for those hand hygiene moments that protect the healthcare worker (i.e., after body fluid exposure, after patient contact) than those that protect the patient (i.e., before an aseptic task).²⁷

7.2.2 Physical environment checklist

An assessment of the unit/bedspace's physical environment should be carried out, to identify what physical resources are in place and what might be needed (e.g., number of sinks, lines on the floor to indicate the patient zone, etc.) to support engagement in hand hygiene. A sample checklist is included in Appendix 2.

7.2.3 Interviews

Short interviews with HCWs can be used to explore the attitudes of healthcare workers to hand hygiene and to find out how they think hand hygiene compliance can be improved. We have found that short discussions with a relatively small number of HCWs (less than 20) can yield very useful information. However, it is important to carry out interviews with a range of HCWs (e.g., porters, doctors, nurses, catering staff) rather than only engaging with one professional group.

Semi-structured interviewing is a particular style of interviewing in which the interviewer has a set list of questions to ask, but is also free to explore other topics that arise naturally in conversation. Appendix 3 contains a short schedule of questions for a semi-structured interview based on the COM-B mode (discussed earlier), which asks participants about their knowledge and skills (Capability), aspects of the physical and social environment (Opportunity), and their motivations to engage in hand hygiene (Motivation).

We recommend audio recording interviews where possible. The interviews can then be listened back and transcribed, or summary notes can be taken, to reflect the most salient points of discussion. We recommend performing a basic content analysis on this written record of the interview. The domains from the Theoretical Domains Framework can be used to identify those domains that are mentioned by the interviewees. Efforts should be made to address those domains that are discussed by a large number of the HCWs interviewed. We have included a modified version of the Theoretical Domains Framework, specific to hand hygiene behaviour, and a sample interview with labels in Appendix 4.

²⁵ See HSE guidelines and resources for hand hygiene assessors at: <https://www.hse.ie/eng/about/who/healthwellbeing/infectcont/sth/resources/hand-hygiene-assess/>

²⁶ El-Saed, A., Noushad, S., Tannous, E., Abdirizak, F., Arabi, Y., Al Azzam, S., et al. (2018). Quantifying the Hawthorne effect using overt and covert observation of hand hygiene at a tertiary care hospital in Saudi Arabia. *American Journal of Infection Control*, 46(8), 930-935.

²⁷ Madden, C., Lydon, S., Walsh, C., O'Dowd, E., Fox, S., Lambe, K., et al. (in press). What are the predictors of hand hygiene compliance in the Intensive Care Unit? A cross-sectional observational study. *Journal of Hospital Infection*.

7.2.4 Hand hygiene attitudes questionnaire

Questionnaires can be a useful mechanism to obtain a broad understanding of the attitudes ICU staff have to hand hygiene compliance. A short hand hygiene questionnaire was designed by the project team specifically to gather information about staff attitudes, experiences, and self-reported compliance with hand hygiene. The questionnaire and guidance on how to use it are provided in Appendix 5. Basic statistical analysis can be performed to generate average scores for each question and each scale. Individual questions be used to suggest points where improvements may be possible.

7.2.5 Collate the information in order to identify and classify the barrier(s)

Once the barriers to hand hygiene compliance have been identified, they then need to be classified using the 14 domains of the Theoretical Domains Framework (TDF), outlined earlier in Section 2.3. Classifying the barriers to hand hygiene compliance is necessary in order to identify the most suitable intervention(s). Table 2 provides definitions of each of the TDF domains and examples of corresponding barriers to hand hygiene compliance to help support you to classify the identified barriers to hand hygiene compliance that may emerge from your data.

7.3 Identifying the appropriate intervention

7.3.1 Intervention options

After identifying and classifying the barriers to hand hygiene compliance using the TDF domains, the next step is to identify a specific intervention, or interventions, that will address these specific barriers. A total of 21 potential hand hygiene interventions are included in this toolkit, listed in Table 3 (see Appendix 6 for a more detailed description). These 21 hand hygiene interventions were identified from the research literature and with detailed input from national and international health services and infection control researchers, frontline ICU staff, and members of the public.

Table 2. Identifying barriers to hand hygiene (HH) compliance using the TDF domains.

TDF domain barriers*	Definition of barriers	Example barriers to HH compliance
Physical skills	Lack of ability or proficiency.	<ul style="list-style-type: none"> HCWs know when to wash their hands, but their technique is poor or hasty.
Knowledge	Lack of knowledge.	<ul style="list-style-type: none"> HCWs do not understand all of the moments for HH. There is confusion about when HH is required.
Memory, attention and decision processes	The failure to retain information, maintain attention, or correctly choose between alternatives.	<ul style="list-style-type: none"> HCWs frequently forget to practise HH HH is not yet ingrained as a habit on the team. HCWs are frequently distracted from HH at critical moments.
Behavioural regulation	An individual's failure to monitor and regulate their own behaviour.	<ul style="list-style-type: none"> HCWs do not monitor their own behaviour or 'catch' themselves when they forget to perform HH.
Environmental context and resources	Circumstances in the physical or social environment that discourage the development of appropriate skills, abilities, or behaviours.	<ul style="list-style-type: none"> HCWs report a lack of resources and/or time due to low staffing. HH is a considered a secondary priority; the physical layout of the unit uncondusive to prioritising HH.
Social influences	Interpersonal processes that can discourage individuals from engaging in beneficial behaviours.	<ul style="list-style-type: none"> Social culture in ICU is not conducive to HH. Senior staff do not model good practice. Reminders about HH are perceived as hostile or nagging.
Professional/social role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting that may inhibit certain behaviours.	<ul style="list-style-type: none"> HH is perceived to be the purview of the infection control team or nurses only.
Beliefs about capabilities	Failure to accept the truth, reality or validity about an ability, talent or facility that a person can put to use.	<ul style="list-style-type: none"> HCWs have inaccurate beliefs about their own compliance and skills.
Pessimism	Lack of confidence that things will happen for the best or that desired goals will be attained.	<ul style="list-style-type: none"> HCWs are pessimistic about HH and infection control.
Beliefs about consequences	Failure to accept the truth about the outcomes of a behaviour.	<ul style="list-style-type: none"> HCWs do not believe that HH is effective in tackling HAI.
Intentions	A conscious decision to perform (or not perform) a behaviour.	<ul style="list-style-type: none"> HCWs do not consciously think about HH and try and improve their own practice.
Goals	Failure to make appropriate use of mental representations of outcomes or end states that an individual wants to achieve.	<ul style="list-style-type: none"> HCWs are discouraged by very high targets for HH (>80%).
Reinforcement	Failure to reward or recognise positive behaviours, leading to lack of encouragement or incentive to continue.	<ul style="list-style-type: none"> HCWs' efforts to improve HH are not rewarded or acknowledged. Good practice doesn't become a long-term habit.
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements that may inhibit engagement in certain behaviours.	<ul style="list-style-type: none"> Discussions about HH and improvement efforts lead to feelings of fear, shame or stress.

*The TDF domains and definitions have been adapted in order to better support the identifications of barriers to hand hygiene compliance.

Table 3. Interventions and corresponding intervention functions.

Number	Intervention	Page	Function
1	Ensure availability of essential supplies for hand hygiene behaviour Availability of necessary supplies for hand hygiene	49	Enablement
2	Providing strong hand hygiene role models within professional groups Leaders recruited to provide a good example to staff, model good hand hygiene behaviour	50	Modelling
3	Comprehensive active education and training for hand hygiene Education and training in basic skills and knowledge, regular top-up sessions	51	Education/ training
4	Continuous education through visual communications Use of printed materials and multimedia to reinforce the hand hygiene message	53	Education/ training
5	Peer-to-peer accountability and support Friendly reminders, feedback and support for good practice	54	Enablement
6	Monitoring and feedback at unit level Hand hygiene compliance monitored at unit level with feedback to staff	56	Persuasion
7	Ongoing/top-up education and training Refresher education and training	57	Education/ training
8	Tailored education and training for professional groups Training tailored to the needs of each professional group	58	Education/ training
9	Support for improving the local institutional safety culture Fostering of a positive, robust institutional safety culture	59	Environmental restructuring
10	Inclusion of hand hygiene behaviour in all procedural protocols Guidelines for hand hygiene included in any relevant protocols	60	Restrictions
11	Implementation of universal contact precautions during outbreaks of serious infectious illness. Additional precautions for all patients during outbreaks of serious infectious illness	61	Restrictions
12	Screening and identification of patients carrying MRSA and other "superbugs". Patients screened on admission to identify carriers of "superbugs" to allow for additional precautions	62	Persuasion
13	Consultation with frontline staff about hand hygiene improvement Action plans are developed based on staff feedback on barriers to hand hygiene compliance, realistic targets, etc.	63	Incentivisation
14	Simulation training for hand hygiene. Simulation and debriefing in a supportive learning environment	64	Education/ training
15	Proactive corrective action Corrective action for unsatisfactory compliance	65	Coercion
16	Competitions, prizes and rewards. Material rewards for satisfactory compliance and achieving targets	66	Incentivisation
17	Get staff feedback on the alcohol hand gel to be made available in units for hand cleansing. Different types of gel trialled and staff feedback solicited to inform procurement	67	Enablement
18	Demonstrated support for hand hygiene from hospital leadership Hospital leadership show support for hand hygiene efforts	68	Environmental restructuring
19	Monitoring and feedback for individual staff members Hand hygiene compliance monitored at individual level with specific feedback	69	Persuasion
20	Warning letters. Warning letters issued to staff members who are repeatedly negligent in hand hygiene compliance	70	Coercion
21	Hand hygiene breaks. Regular breaks scheduled during which all staff on the unit pause and engage in hand hygiene	71	Environmental restructuring

7.3.2 Matching barriers to interventions

In order to select which of these 21 hand hygiene interventions is appropriate, you must consider the TDF domains with which the interventions are associated. Each TDF domain is listed below in Table 4 along with the appropriate interventions to address the barriers associated with each of the 14 TDF domains. A full description of each intervention, and its implementation, is provided in Appendix 6. When going through this process of linking the barriers to appropriate intervention(s), there are a number of points to consider:

- It may not be feasible to address every barrier to HH compliance that was identified in a single intervention. It is

possible to use a bundle of more than one intervention, but consideration should be given to the resources and motivation required to carry out a large bundled intervention. The more resources required, the less sustainable an intervention may be.

- As can be seen from Table 4, some of the interventions may address more than one barrier. For example, peer-to-peer accountability and support (Intervention 5) can address barriers related to memory and attention, environmental context, social influences, professional identity, pessimism, beliefs about capabilities, intentions, goals and reinforcement.
- Therefore, it may be possible to select and implement a single intervention that addresses more than one barrier.

Table 4. TDF domains and associated interventions.

<p>TDF Domain 1. Physical skills Intervention functions: Training</p> <ul style="list-style-type: none"> • Additional training sessions to demonstrate proper technique (Interventions 3, 8, 14). • Give HCWs a chance to perfect it under the supervision of a trained expert with individual feedback (Intervention 19).
<p>TDF Domain 2. Knowledge Intervention functions: Education</p> <ul style="list-style-type: none"> • Top-up education to remind HCWs of the moments and clarify any misunderstandings (Interventions 3, 7, 8, 14).
<p>TDF Domain 3. Memory, attention and decision processes Intervention functions: Training, Environmental restructuring, Enablement</p> <ul style="list-style-type: none"> • Top-up training to reinforce the habit of hand hygiene and train HCWs to recognise the cues (Intervention 7). • Restructure the physical environment to include triggers and fresh reminders (Intervention 4). • Restructure the social environment so that colleagues can remind and support one another (Intervention 5). • Senior staff model good practice (Interventions 2). • Ensure that supplies are at hand so that hand hygiene is easy to do (Intervention 1).
<p>TDF Domain 4. Behavioural regulation Intervention functions: Education, Training, Modelling, Enablement</p> <ul style="list-style-type: none"> • Provide education and training on self-monitoring and goal-setting strategies for individual HCWs and teams (Interventions 8, 13, 14). • Encourage senior staff to model good practice and check their own behaviour, owning up to mistakes and implementing personal strategies to do better (Interventions 2, 8). • Ensure that supplies are at hand so that hand hygiene is easy to do (Intervention 1). • Address resourcing / staffing problems so that HCWs have sufficient time to perform hand hygiene (Intervention 9).

TDF Domain 5. Environmental context and resources

Intervention functions: Training, Restriction, Environmental restructuring, Enablement

- Provide training on specific scenarios in ICU to ensure that hand hygiene is incorporated into critical procedures to the best of the HCW's ability, even under pressure (Interventions 8, 10, 14).
- Introduce rules or failsafes/forcing functions (Interventions 10, 11).
- Promote a social culture that respects and prioritises hand hygiene, normalising friendly reminders between HCWs (Intervention 5).
- Ensure that physical resources are available (Intervention 1).
- Address resourcing/staffing issues where possible (Intervention 9).

TDF Domain 6. Social influences

Intervention functions: Restriction, Environmental restructuring, Modelling, Enablement

- Introduce appropriate rules or fail-safes/ forcing functions, demonstrating that hand hygiene is part of the way things work in the ICU (Interventions 1, 10).
- Promote a social culture that respects and prioritises hand hygiene, normalising friendly reminders between HCWs (Intervention 5).
- Ensure that physical resources are available (Intervention 1).
- Address resourcing/staffing issues where possible (Intervention 9).
- Appoint staff to act as role models and demonstrate good hand hygiene practice as an example to their colleagues (Intervention 2).

TDF Domain 7. Professional/social role and identity

Intervention functions: Education, Persuasion, Modelling

- Provide segregated education sessions (Intervention 8).
- Appoint role models for each professional group to demonstrate that hand hygiene applies to everyone (Intervention 2).
- Provide credible information and feedback on performance from respected colleagues (Interventions 3, 5, 6, 19).

TDF Domain 8. Beliefs about capabilities

Intervention functions: Education, Persuasion, Modelling, Enablement

- Incorporate demonstrations into education and training to allow HCWs to see the effectiveness of their own practice (Interventions 3, 7, 14).
- Provide credible information and feedback on performance from respected colleagues (Interventions 3, 5, 6, 19).
- Appoint role models to show that hand hygiene should be a priority for everyone (Intervention 2).

TDF Domain 9. Pessimism

Intervention functions: Education, Persuasion, Modelling, Enablement

- Provide credible information and education about the science behind hand hygiene and evidence for its effectiveness, particularly from the local context (Intervention 3).
- Appoint senior staff members to model good practice in every professional group (Intervention 2).
- Ensure that supplies are at hand so that hand hygiene is easy to do (Intervention 1).

TDF Domain 10. Beliefs about consequences

Intervention functions: Education, Persuasion, Modelling

- Provide credible information and education about the science behind hand hygiene and feedback on performance from respected colleagues (Intervention 3, 5, 7, 8, 19).
- Appoint senior staff members to model good practice in every professional group (Intervention 2).
- Introduce disciplinary measures for poor performance if necessary (Interventions 15, 20).

TDF Domain 11. Intentions

Intervention functions: Education, Persuasion, Incentivisation, Coercion, Modelling

- Provide segregated education session (Intervention 8).
- Appoint role models for each professional group to demonstrate that hand hygiene applies to everyone (Intervention 2).
- Provide credible information and feedback on performance from respected colleagues (Interventions 3, 5, 6, 19).
- Introduce disciplinary measures for poor performance if necessary (Interventions 15, 20).
- Provide rewards and acknowledgement for good performance at unit and individual level (Interventions 13, 16).

TDF Domain 12. Goals

Intervention functions: Education, Persuasion, Incentivisation, Coercion, Modelling, Enablement

- Provide education sessions on the value of excellent compliance, demonstrating its effectiveness (Interventions 3, 7, 8).
- Provide role models for each professional group to demonstrate that hand hygiene applies to everyone (Intervention 2).
- Provide credible information and feedback on performance from respected colleagues (Interventions 3, 5, 6, 19).
- Introduce disciplinary measures for poor performance if necessary (Interventions 15, 20).
- Provide rewards and acknowledgement for good performance at unit and individual level (Interventions 13, 16).
- Ensure that supplies are at hand so that hand hygiene is easy to do (Intervention 1).

TDF Domain 13. Reinforcement

Intervention functions: Training, Incentivisation, Coercion, Environmental restructuring

- Provide regular training (Intervention 7).
- Provide feedback on performance (Interventions 6, 19).
- Introduce disciplinary measures for poor performance if necessary (Interventions 15, 20).
- Provide rewards and acknowledgement for good performance at unit and individual level (Interventions 13, 16).
- Promote an encouraging social atmosphere around hand hygiene, wherein reminders and interventions are regarded as supportive rather than hostile or punitive (Intervention 5).
- Schedule hand hygiene breaks when everyone safely stops their work and washes their hands (Intervention 21).

TDF Domain 14. Emotion

Intervention functions: Persuasion, Incentivisation, Coercion, Modelling, Enablement

- Provide education sessions on the value of excellent compliance, demonstrating its effectiveness (Interventions 3, 7, 8).
- Provide credible information and feedback on performance from respected colleagues (Interventions 3, 6, 7, 19).
- Introduce disciplinary measures for poor performance if necessary (Interventions 15, 20).
- Provide rewards and acknowledgement for good performance at unit and individual level (Interventions 13, 16).
- Ensure that supplies are at hand so that hand hygiene is easy to do (Intervention 1).

7.3.3 Additional considerations for intervention selection

The utility of any given hand hygiene intervention rests fundamentally on whether it is suited to address the specific barriers that are negatively impacting hand hygiene compliance in a specific setting. Other factors, however, are also important, such as affordability, practicability, and possible unintended consequences of implementing the intervention.

As mentioned earlier, the research evidence supporting the effectiveness of any particular intervention is weak. Therefore, in order to provide some information on the likely effectiveness of each intervention, we gathered feedback on each of the interventions from 39 stakeholders (11 members of the public, 11 ICU doctors, 10 ICU nurses, and 7 health services researchers).

For each intervention, the stakeholders rated their agreement with each of the following six dimensions on a scale from 0 (strongly disagree) to 100 (strongly agree):

1. **Affordability:** intervention can be delivered within an acceptable budget.
2. **Practicability:** intervention can be delivered with minimal disruption to patient care.
3. **Effectiveness:** intervention is likely to improve hand hygiene compliance.
4. **Acceptability:** intervention will be considered appropriate by staff in the ICU.
5. **Side effects/safety:** intervention will not have any unwanted side-effects or unintended consequences.
6. **Equity:** intervention can be delivered in any ICU in the Republic of Ireland.

The average (mean) overall score for each intervention is provided in Table 5. Detailed scores for each of the dimensions is listed alongside each intervention in Appendix 6.

Two of the interventions that were identified and evaluated involved either coercion or reprimands. These interventions were **proactive corrective action** (Intervention 15) and **warning letters** (Intervention 20). Both of these interventions were relatively unfavourably rated by the stakeholders as compared to the other interventions assessed (see Table 5). There is a risk that using these interventions will lead HCWs to cover up any errors that are made. Such approaches are counter to the 'just culture' most healthcare organisations wish to foster. A just culture recognises that healthcare professionals make errors and may take shortcuts or fail to follow protocols. There may be good reasons why staff do not follow procedures (e.g., not following hand hygiene protocols during an arrest due to urgency of care delivery). In a just culture, it is recognised that there is a need to understand why healthcare professionals make errors and the importance of encouraging honest reporting from healthcare workers as to why things may go wrong. Therefore, these two interventions are **not recommended** for use, but are included for completeness.

Table 5. Mean intervention scores (max score achievable is 100), ranked by mean score in descending order of stakeholder rating.

Rank	Intervention	Page	Mean score
1	Ensure availability of essential supplies for hand hygiene behaviour	49	82
2	Providing strong hand hygiene role models within professional groups	50	74
3	Comprehensive active education and training for hand hygiene	51	74
4	Continuous education through visual communications	53	73
5	Peer-to-peer accountability and support	54	73
6	Monitoring and feedback at unit level	56	71
7	Ongoing/top-up education and training	57	70
8	Tailored education and training for professional groups	58	70
9	Support for improving the local institutional safety culture	59	70
10	Inclusion of hand hygiene behaviour in all procedural protocols	60	70
11	Implementation of universal contact precautions during outbreaks of serious infectious illness	61	70
12	Screening and identification of patients carrying MRSA and other "superbugs"	62	69
13	Consultation with frontline staff about hand hygiene improvement	63	69
14	Simulation training for hand hygiene	64	68
15	Proactive corrective action	65	67
16	Competitions, prizes and rewards	66	66
17	Get staff feedback on the alcohol hand gel to be made available in units for hand cleansing	67	65
18	Demonstrated support for hand hygiene from hospital leadership	68	65
19	Monitoring and feedback for individual staff members	69	60
20	Warning letters	70	59
21	Hand hygiene breaks	71	54

8

Stage 2 -
Do

8. Stage 2 - Do

Having selected an intervention that will address local problems in a targeted way, the team can now implement the intervention. Broad information on the interventions is provided in Appendix 6. However, the intervention team will need to consider how the intervention can be implemented in a specific unit, and ensure that the relevant resources is in place to support the intervention. Although the specifics of the implementation will vary between interventions, some general principles apply and are described here.

8.1 Baseline measurements

In the Plan stage, you will have already determined relevant measures of success; these may include levels of observed compliance with hand hygiene guidelines, reported levels of compliance, number of hand rub dispensers, attitudes to hand hygiene, etc. At the beginning of the Do stage, take baseline, pre-test measurements of these indicators. At the end of the intervention, you will take these measurements again so that "before and after" comparisons can be made.

8.2 Establish buy-in

A sense of ownership is key to implementing any change successfully, and a broad base of support should be established before implementing an intervention. The data-gathering activities from the Plan stage should have provided you with a sense of the general attitude on the ground to efforts to improve hand hygiene, and involving a wide range of stakeholders in the trial will help to reduce barriers to change and identify problems before they arise. As far as possible, trial the change with people who already believe in its

value and leave "converting" others for later. Your analysis of results in the Study stage will help you to develop your team's confidence in the intervention and build a case to present to others at a later date.

8.3 Monitor the process

Monitoring involves systematically tracking the progress of activities and changes that are implemented to assess whether the objectives of the intervention have been achieved. All activities in the intervention should be monitored and documented to ensure that the intervention is on track and that stumbling blocks and problems are recognised and addressed. The nature and frequency of this monitoring will depend on the intervention itself, but observations, informal check-ins with healthcare workers, anonymous feedback systems, and examinations of relevant records could all form part of a monitoring programme over the course of an intervention trial. Attend closely to points of friction, problems, and unexpected observations.

For example, if a team is implementing an intervention in which role models are appointed and trialled over the course of six weeks, the team may wish to monitor the numbers of role models completing training, their feedback on the training programme, the amount of time they spend acting in their capacity as role model, the number of interactions they have with other staff in that capacity, and the feedback of other staff members about their experience of the role model programme.

9

Stage 3 - Study

9. Stage 3 – Study

Evaluation is extremely important in order to understand the effects of the changes that have been made. In the Plan stage, you will have already determined relevant measures of success; these may include levels of observed compliance with hand hygiene guidelines, reported levels of compliance, number of hand rub dispensers, attitudes to hand hygiene, etc. You will have started the Do stage by taking baseline, pre-test measurements of these indicators. At the end of the intervention trial, take these measurements again.

In the Study stage, the data collected before the intervention are compared with the same data collected after the intervention or after a certain duration of implementation. This will allow a determination to be made as to whether the intervention has had the desired effect. The findings should be summarised and shared in order to reflect on what has been learned. Remember that a failed test is still useful, so study both positive and negative findings carefully.

9.1 Insight about outcomes

Data on any change in observed hand hygiene compliance may appear to be the most appropriate approach to assessing the impact of the intervention. However, as

discussed at the beginning of the toolkit, although considered the gold standard, there are potentially issues with those being observed not behaving as they would if they were not being observed. Therefore, it is important to consider the other methods of measurement outlined in the Plan section of the toolkit, such as the physical environment checklist (see Appendix 2), interviews (see Appendix 3), and the hand hygiene attitudes questionnaire (see Appendix 5). If these methods were used in the plan stage, the findings can then be compared to assess the impact of the intervention.

9.2 Unintended consequences

Healthcare is a complex system, and changes in one area may have knock-on effects on another. Intervention teams should therefore be sensitive to the possibility that the changes they make may have unintended consequences, which should be recognised and mitigated where necessary. For example, it may be that the time taken to engage in hand hygiene is resulting in less time to perform other important tasks. The collection of qualitative data may assist with the identification of such effects or instances.

Evaluation is extremely important in order to understand the effects of the changes that have been made.

10

Stage 4 - Act

10. Stage 4 – Act

Now that the intervention has been trialled and its effects have been evaluated, the team can choose what action to take. One of the most important aspects of the Plan-Do-Study-Act model is its cyclical nature; as one cycle closes, the next can begin, to ensure that continuous improvement can be maintained. How this improvement should be achieved will depend on the outcome of the evaluation

10.1 The intervention was effective

If the intervention was effective, there is a need to consider how to sustain the changes. Sustaining any improvements can be challenging, and it is very easy to fall back into bad practices. Therefore, there is a need to consider how the change can be transitioned from an intervention to becoming part of normal working practices. How this is executed will depend on the nature of the intervention. For example, if the intervention was providing strong hand hygiene role models within professional groups, this is something that needs to be encouraged to continue. The positive findings from the intervention should be helpful in this regard. It may be that the intervention could continue, though not at the same intensity. It may also be necessary to continue to monitor the intervention, or it may be that the intervention was effective, but modifications are necessary for the next time it is delivered. This is likely true for any education or training interventions. Plans should also be put in place to maintain the continuity of any intervention, particularly if staff changes are likely over time. Plans for periodic review should be put in place, to ensure that its effectiveness is maintained over the longer term. Finally, it is important that the findings from any effective intervention are shared with other units.

10.2 The intervention was ineffective

If the intervention was ineffective, there is a need to understand why this is the case. This will require careful scrutiny of evaluation data. It may not be the intervention, but the manner in which the intervention was implemented that led to the lack of an effect. For example, if there was little buy-in and support from staff and leadership, then the intervention is unlikely to be effective. Therefore, it is important to consider why an intervention has not had the expected impact. Changes can then be made based on the evaluation data, and the intervention can be implemented and re-evaluated. However, if there are fundamental issues with the implementation of the intervention, such as lack of buy-in, it may be that it should be concluded that this is not the appropriate time to implement the intervention.

10.3. Aspects of the intervention were effective, but it did not completely have the desired effect

It may be that the intervention was neither a complete success or failure, with some aspects found to be effective and others not. This may be particularly the case with a bundled intervention, in which some of the interventions were effective, and others did not have the desired effect. In this case, those aspects of the intervention that were effective should be brought into normal working practices (as described above for an effective intervention), and the reasons why aspects of the intervention were ineffective should be considered (as described above for an ineffective intervention).

11

Conclusions

12

Acknowledgments

11. Conclusions

In conclusion, despite the large financial and logistical investments required to implement a hand hygiene intervention, hospitals and regulators must make decisions regarding infection control policies in the absence of scientific consensus on what is effective. It is hoped that this toolkit can provide guidance on how to can be provided as to the hand hygiene interventions that are at likely to be effective (or not) in a particular ICU unit.

12. Acknowledgments

The authors would like to acknowledge the huge amount of help, support, and guidance from the staff in ICUs across Ireland. It would not have been possible to complete this toolkit without their help and support.

Appendix

Appendix 1. A Moment for Hand Hygiene – Project outcomes

A1.1 Project summary and findings

A1.1.1 Background

Hand hygiene practices are the most effective way to prevent healthcare-associated infections. However, compliance has been historically low. Interventions to improve compliance have been trialled but are not generally evidence-based and their effects are poorly understood.

A1.1.2 Objectives

This project aimed to use theories of behavioural change and implementation science to provide a unified approach to hand hygiene in the Intensive care unit (ICU).

A1.1.3 Current levels of compliance internationally and nationally

A systematic review of 61 studies examining compliance with hand hygiene in the ICU using the WHO guidelines found a mean compliance of 59.6%. Observations (n=712 hand hygiene opportunities) in three ICUs and one HDU in Ireland found a mean hand hygiene compliance of 56.9%. Preliminary analysis suggests higher hand hygiene compliance for those hand hygiene moments that protect the worker (i.e., after body fluid exposure, after patient contact) as compared to those that protect the patient (i.e., before an aseptic task).

A1.1.4 Hand hygiene policy landscape in Ireland

A review of national-level policies and guidelines for hand hygiene in ICU and

interviews with policy makers found that documents are brief, with little to guide improvement. Policy makers and stakeholders (n=12) emphasised the need for ongoing training and importance of social factors. Policy makers and stakeholders were also sceptical of the impact of protocols on real-world hand hygiene practice.

A1.1.5 Views of ICU staff

Interviews with 26 ICU staff found that they were confident in their ability to carry out appropriate hand hygiene behaviours. Social influence was regarded as being important in encouraging hand hygiene compliance by the interviewees- particularly by nurses. The participants were motivated to carry out hand hygiene behaviours, and it was recognised that hand hygiene was important in preventing infection. A survey of 292 ICU staff found that capability, opportunity and motivation were significant predictors of self-reported intentions to perform hand hygiene. However, data suggested ICU staff tend to overestimate their levels of hand hygiene compliance.

A1.1.6 Hand hygiene interventions

A systematic review of 38 studies of interventions to improve hand hygiene compliance in the ICU found that studies had poor methodological rigour, and best practice for improving compliance is unestablished. Experts in hand hygiene and behaviour change in healthcare took part in a workshop to generate potential interventions to improve hand hygiene compliance. These interventions, combined with those described in the systematic review, were evaluated by a panel of ICU staff, health services researchers, and patient representatives. Ensuring availability of essential supplies for hand hygiene behaviour was the highest rated intervention. Interventions involving role models and peer-to-peer accountability and support were also well regarded. Education/training interventions were commonplace and popular. Punitive interventions were poorly rated.

A1.1.7 Main findings

There is no universal solution to improving hand hygiene compliance. There is a lack of evidence to support the effectiveness of any particular intervention or bundle of interventions. There is a need for interventions to be tailored to the specific needs of a particular unit rather than a one-size-fits-all approach. Although ICU staff generally believe they have the knowledge of how to carry out hand hygiene, they tend to overestimate levels of compliance. Setting national compliance targets of 90% may not be useful. Interventions involving role models, peer-to-peer accountability and support, and education and training are well-regarded by key stakeholders and represent important avenues for future research.

Lydon S., Power M., McSharry J., Byrne M., Madden C., Squires J.E., et al. (2017). Interventions to improve hand hygiene compliance in the ICU: A systematic review. *Critical Care Medicine*, 45(11):e1165-e72.

Madden, C., Lydon, S., Lambe, K., O'Connor, P. (2019). Irish policy-makers' perceptions of barriers and facilitators to hand hygiene compliance. *Irish Medical Journal*, 112(4):914.

Madden, C., Lydon, S., Walsh, C., O'Dowd, E., Fox, S., Lambe, K., et al. (in press). What are the predictors of hand hygiene compliance in the Intensive Care Unit? A cross-sectional observational study. *Journal of Hospital Infection*.

Reddy, K., Byrne, D., Breen, D., Lydon, S., O'Connor, P. (2020). The application of human reliability analysis to three critical care procedures. *Reliability Engineering and System Safety*, 203.

A1.2 Published papers

Lambe K, Lydon S, Madden C, McSharry J, Marshall R, et al. (2020). Understanding hand hygiene behaviour in the intensive care unit to inform interventions: an interview study. *BMC Health Services Research*, 20: 353.

Lambe KA, Lydon S, Madden C, Vellinga A, Hehir A, Walsh M, et al (2019). Hand hygiene compliance in the intensive care unit: A systematic review. *Critical Care Medicine*, 47(9): 1251-1257.

Lavelle, A., White, M., Griffiths, M., Byrne, D., & O'Connor, P. (under review). Human reliability analysis of bronchoscope assisted percutaneous dilatational tracheostomy: implications for simulation based education.

Lydon, S., Grealley, C., Tujjar, O., Reddy, K., Lambe, K., Madden, C., et al. (2019). Psychometric evaluation of a measure of factors influencing hand hygiene behaviour to inform intervention. *Journal of Hospital Infection*, 102(4):407-412.

Appendix 2. Physical environment checklist

1. There is a hand hygiene sink in the room
2. In a multi-bedded room, the number of hand hygiene sinks is sufficient to meet the national guidelines
3. The hand hygiene sink(s) conforms to HBN 00-10 Part C Sanitary Assemblies
4. Taps should be either elbow/knee or sensor operated
5. Soap dispensers are in good working order
6. Soap dispenser nozzles are clean
7. Adequate amount of liquid handwash soap is available
8. Adequate amount of antiseptic handwash liquid is available (if applicable)
9. Alcohol hand rub is available at the point of care
10. Disposable paper towel dispenser is in good working order
11. Adequate number of disposable paper towels are available
12. Waste bin is in good working order
13. Hand hygiene poster is displayed at each sink
14. Access to hand hygiene sink is not obstructed

Bed	Indicators														Comments
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1	Y	Y	ND	N	Y	Y	NC	Y	Y	Y	Y	Y	Y	N/A	

Key Y: Y = yes, N = No, N/A = Not Applicable, ND = Not Documented, NC = Not Checked.

Adapted from: Strategy for the control of Antimicrobial Resistance in Ireland Subcommittee. (2005). Guidelines for Hand Hygiene in Irish Health Care Settings. Available from: <https://www.hse.ie/eng/services/publications/healthprotection/guidelines-for-hand-hygiene-in-irish-health-care-settings-.pdf>. Accessed 3 September 2020.

Appendix 3. Sample staff hand hygiene interview schedule

COM-B Domain	Interview Question
Capability	What training have you received in appropriate hand hygiene practices?
	Are you confident in your knowledge of hand hygiene protocols or do you think further training or supports are needed?
	What prompts are there to remind staff when and how to engage in hand hygiene practices in the ICU ward?
Opportunity	How is there a focus on encouraging adherence to hand hygiene protocol in this unit?
	Do you have enough time to adhere to hand hygiene protocol for each patient or is that difficult?
	What materials are necessary (e.g., sanitisation gel) for hand hygiene and are these always available to you on the ward?
Motivations	What factors hinder you from adhering to hand hygiene guidelines?
	What factors encourage you to adhere to hand hygiene guidelines?
	Do you think adherence to hand hygiene protocol is important for patient safety and why?

Adapted from: Lambe, K., Lydon, S., Madden, C., McSharry, J., Marshall, R., Boylan, R, et al. (2020). Understanding hand hygiene behaviour in the intensive care unit to inform interventions: an interview study. *BMC Health Services Research*, 20, 353.

Appendix 4. Sample coded staff hand hygiene interview and Theoretical Domains coding framework

A4.1 Theoretical Domains coding framework

Code / label	Quotes referring to...
1. Knowledge	Knowledge / scientific rationale / Procedural knowledge / Knowledge of task environment
2. Skills	Skills / Skills development / Competence / Ability / Interpersonal skills / Practice / Skills assessment / Top-up training
3. Social/professional role and identity	Professional identity / Professional role / Social identity / Identity / Professional boundaries / Professional confidence / Group identity / Leadership / Organisational commitment
4. Beliefs about capabilities	Self-confidence / Empowerment / Perceived competence / Self-esteem / Self-efficacy / Perceived behavioural control / Beliefs / Professional confidence
5. Optimism	Optimism / Pessimism / Unrealistic optimism / identity
6. Beliefs about Consequences	Beliefs / Outcome expectancies / Characteristics of outcome expectancies / Anticipated regret / Consequents
7. Reinforcement	Rewards (proximal/distal, valued/not valued, probable/improbable) / Incentives / Punishment / Consequents / Reinforcement / Contingencies / Sanctions
8. Intentions	Stability of intentions / Stages of change model / Transtheoretical model and stages of change
9. Goals	Goals (distal/proximal) / Goal priority / Goal/target setting / Goals (autonomous/controlled) / Action planning / Implementation intention
10. Memory, attention and decision processes	Memory / Attention / Attention control / Decision making / Cognitive overload / Tiredness / Habit
11. Environmental context and resources	Environmental stressors / Organisational culture/climate / Salient events/critical incidents / Person x environment interaction / Barriers and facilitators / Prompts / Organisational policy / More specific labels may be of use: Resources: Material resources / Resources: Time / Resources: Workload / Resources: Staffing
12. Social influences	Social pressure / Social norms / Group conformity / Social comparisons / Group norms / Social support / Power / Intergroup conflict / Alienation / Group identity / Modelling / Monitoring/surveillance
13. Emotion	Fear / Anxiety / Affect / Stress / Depression / Positive/negative affect / Burn-out / Moral obligation
14. Behavioural regulation	Self-monitoring / Breaking habits / Action planning

A4.2 Sample coded interview

Interview text	Codes
<p>What training have you received in appropriate hand hygiene practices?</p> <p>We had a tutorial during our intern week. And then we've had sporadic training by the different hand hygiene officers in the different hospitals. They're mandatory, every six months I think. And there are online e-learning things too.</p>	
<p>Are you confident in your knowledge of hand hygiene protocols or do you think further training or supports are needed?</p> <p>Yes, I'm fairly confident. I've been working for a few years now and I've been assessed a lot, so yes, I know the physical procedure inside out. I think the training has been adequate, but it's no harm to brush up every now and then, though. Sometimes there's confusion about when you have to do it and it's good to get that straight in your head again.</p>	<p>Beliefs about capabilities Skills</p> <p>Knowledge</p>
<p>What prompts are there to remind staff when and how to engage in hand hygiene practices in the ICU ward?</p> <p>We have our red line on the floor, and before we cross the red line we use the alcohol gel. After we finish with the patient and we exit the red line, we wash our hands. That would be our prompt really. And you would be told as well, infection control go around and they spot-check people for jewellery, bare below the elbow and all that. They're very visible on the ward. In one hospital where I was, there was a sign saying that it's bare below the elbows past this point, hang up your jacket.</p>	<p>Environmental context and resources</p> <p>Social influences</p> <p>Environmental context and resources</p>
<p>How is there a focus on encouraging adherence to hand hygiene protocol in this unit?</p> <p>The audits are a big thing. Apparently we're above ninety per cent, so that's great, and you want to keep that going. And I must say the nurses are particularly good, and they advocate for it a lot, getting the consultants or doctors to put on the aprons or wash their hands.</p>	<p>Reinforcement</p> <p>Social influences</p>
<p>Do you have enough time to adhere to hand hygiene protocol for each patient or is that difficult?</p> <p>Yes, generally we do. It's easier in ICU where you're one-to-one.</p>	<p>Environmental context and resources</p>
<p>What materials are necessary (e.g., sanitisation gel) for hand hygiene and are these always available to you on the ward?</p> <p>There are the sinks, you know, soap and hot water. And everything else is usually well-stocked, like you'd very rarely go to an alcohol hand gel dispenser that's empty. Aprons, gloves, gel, the PPE for normal infection control, universal precautions. We very rarely run out of materials for that. The only resource we're short on would be side rooms.</p>	<p>Environmental context and resources</p>
<p>What factors hinder you from adhering to hand hygiene guidelines?</p> <p>Sometimes in an emergency situation, if a patient needs rapid intervention, sometimes, you know, you won't stop to gel your hands. You just have to cross the red line and get to work. And sometimes you do just forget. That happens. But you do try and watch out for that and do better.</p>	<p>Environmental context and resources</p> <p>Memory, attention and decision processes</p> <p>Behavioural regulation</p>
<p>What factors encourage you to adhere to hand hygiene guidelines?</p> <p>I think a lot about the younger people that start. You want to be a good role model and a good advocate for them. That and the fact that you really don't want to be the person who gave someone an infection. Nobody wants that guilt.</p>	<p>Social influences</p> <p>Emotion</p>
<p>Do you think adherence to hand hygiene protocol is important for patient safety and why?</p> <p>Absolutely, and the patients in ICU are so vulnerable. At the end of the day, you know, this is your patient and you don't want to do them any harm. That's what being a doctor or nurse is all about.</p>	<p>Social / professional role and identity</p>

Appendix 5. Hand hygiene attitudes questionnaire and scoring information

Please read each item below and circle the number that best captures the extent to which you agree with each statement.

1. Strongly Disagree
2. Disagree
3. Neither
4. Agree
5. Strongly Agree

	1	2	3	4	5
1. Capability					
a) I have received adequate training in hand hygiene practices in this unit	1	2	3	4	5
b) I know the moments when hand hygiene is required	1	2	3	4	5
c) I know how to conduct a complete hand wash or rub	1	2	3	4	5
d) I engage in hand hygiene without thinking	1	2	3	4	5
e) I find it easy to adhere to hand hygiene recommendations in this unit	1	2	3	4	5
2. Opportunity					
a) I have enough time to engage in hand hygiene	1	2	3	4	5
b) This unit has adequate facilities for hand hygiene	1	2	3	4	5
c) Nurses in this unit always engage in hand hygiene when required	1	2	3	4	5
d) Doctors in this unit always engage in hand hygiene when required	1	2	3	4	5
e) Healthcare providers visiting this unit always wash their hands when required	1	2	3	4	5
f) The hand hygiene protocols for this unit are clear	1	2	3	4	5
g) There are prompts to remind staff to engage in hand hygiene in this unit	1	2	3	4	5
3. Motivation					
a) Hand hygiene compliance is considered important by staff in this unit	1	2	3	4	5
b) Hand hygiene compliance is considered important by my seniors in this unit	1	2	3	4	5
c) I strive for complete compliance with the five moments of hand hygiene	1	2	3	4	5
d) We remind each other to engage in hand hygiene in this unit	1	2	3	4	5
e) Infection control audits encourage me to adhere to hand hygiene protocols in this unit	1	2	3	4	5
4. Behaviour					
I wash my hands:					
a) Before patient contact	0	1	2	3	4
b) Before aseptic technique	0	1	2	3	4
c) After body fluid exposure risk	0	1	2	3	4
d) After patient contact	0	1	2	3	4
e) After contact with the patient surroundings	0	1	2	3	4

Scoring Key: For each of the four subscales, add the item responses within that subscale together and then divide by the number of items in the subscale order to obtain a mean subscale score. For example, for the Capability subscale, add the responses to the five items and then divide by five in order to obtain the mean subscale score.

Adapted from: Lydon, S., Grealley, C., Tujjar, O., Reddy, K., Lambe, K., Madden, C., et al. (2019). Psychometric evaluation of a measure of factors influencing hand hygiene behaviour to inform intervention. *Journal of Hospital Infection*, 102(4):407-412.

Appendix 6. Intervention descriptions

A systematic literature review and workshop with hand hygiene researchers were carried out to gather a comprehensive list of interventions for hand hygiene that have already been studied or that researchers believe hold promise. A total of 91 interventions were found. By grouping similar interventions, this list was reduced to 21 unique interventions, which are described in full below.

The 21 interventions were presented to a group of 39 stakeholders, including ICU staff, health services researchers, and patient representatives. For each intervention, they were asked to rate their agreement with each of the following statements on a 0 (strongly disagree) to 100 (strongly agree) slider scale:

- **Affordability:** This intervention can be delivered within an acceptable budget.
- **Practicability:** This intervention can be delivered with minimal disruption to patient care.
- **Effectiveness:** This intervention is likely to improve hand hygiene compliance.
- **Acceptability:** This intervention will be considered appropriate by staff in the ICU.
- **Side effects:** This intervention will not have any unwanted side-effects or unintended consequences.
- **Equity:** This intervention can be delivered in any ICU in the Republic of Ireland.

The interventions were then ranked by their overall score. Scores are presented in full for each intervention below.

Intervention Number 1: Ensure availability of essential supplies for hand hygiene compliance

Intervention function: Enablement-increasing means or reducing barriers to increase capability, or opportunity.

Intervention description (What does the intervention involve?)

In this intervention, special care is taken to ensure adequate availability of alcohol based hand gel, sinks with hot water and soap, gloves, and other necessary supplies for hand hygiene within patient care zones in the unit. Supplies are monitored closely, including for evening and weekend shifts, and availability of supplies is checked carefully during hand hygiene audits.

Strengths (What are the strengths associated with this intervention?)

- Supplies are essential to make compliance possible, and their presence in the physical environment can serve as a prompt to perform hand hygiene.
- Individuals can only be fairly held accountable for their behaviour if the physical environment makes it possible for them to readily comply with hand hygiene requirements.

Challenges (What challenges might be encountered in implementing this intervention?)

- Supply levels require close daily monitoring and refilling.
- Adjustments to the physical environment may not be possible everywhere (e.g., some units may not have space for new sinks).

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required so that supply levels can be carefully monitored and regularly refilled.
- Financial resources will need to be committed to ensure availability of supplies.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
1	82.0	74.5	82.0	82.0	88.6	83.5	82.3

Stakeholder comments:

Agreement that this is vital, "a no-brainer", "an absolute must"; some statements that availability is not generally a problem.

Intervention Number 2: Strong hand hygiene role models within professional groups

Intervention function: Modelling- providing an example for people to aspire to or imitate.

Intervention description (What does the intervention involve?)

In this intervention, leaders are recruited at unit level within specific professional groups (e.g., doctors, nurses) to provide a good example to other staff, model good hand hygiene behaviour and support their peers in doing the same, offering reminders, recognition and informal praise for good performance. These individuals also champion and promote ongoing hand hygiene initiatives.

Strengths (What are the strengths associated with this intervention?)

- Role models have a powerful effect, particularly if they are senior staff whose behaviour junior colleagues will copy.
- Having role models within different professional groups ensures that everyone has a role model to which they can relate.
- Role models within different professional groups know the unique challenges their group faces and can help to mentor their colleagues in dealing with these challenges.

Challenges (What challenges might be encountered in implementing this intervention?)

- It may be difficult to access busy senior staff and justify the use of their time for this intervention.
- Hand hygiene role models and champions must be carefully selected for the right personal qualities; they should be well-respected, approachable and encouraging of their peers.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to train the selected role models and to update training as required over time. This training may also require other resources (e.g., information packs, meeting space).
- Role models will need to devote some of their time each day to observe and offer feedback and support to their colleagues.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
2	74.0	76.7	75.0	71.4	73.5	66.1	80.6

Stakeholder comments:

Choice of role model and quality of interpersonal relationships on the ward would be key determinants of success. Some concern that this would be demoralising or nagging.

Intervention Number 3: Comprehensive active education and training for hand hygiene

Intervention function: Education/ training- increasing knowledge or understanding/imparting skills.

Intervention description (What does the intervention involve?)

In this intervention, staff responsible for training in hand hygiene ensure a high standard of comprehensive education and training in basic skills and knowledge, and top up this training on a regular basis as required. This intervention may take many forms and should be tailored according to the needs and resources available at the local level. Some components of an educational programme may include the following:

- Provide education on theoretical issues and evidence-based practices.
- Provide ad-hoc inservice training as required and consider 1:1 sessions with immediate feedback at the bedside.
- Consider carefully the appropriateness of different formats and modes of teaching: videos, coaching, online modules, group education, literature on the ward, practical demonstrations with UV gel and fingertip methods.
- Consider the duration of training sessions carefully: short workshops, lunchtime sessions, day-long seminars, etc.
- Include education on the most up-to-date antiseptic, indications and instructions.
- Educate staff about current campaigns and provide sample language they can use to help patients, families, visitors and peers understand the importance of hand hygiene.
- Employ emotional or fear-based tactics with care to make the consequences of poor hand hygiene feel personal and urgent.

Strengths (What are the strengths associated with this intervention?)

- Basic knowledge of indications and technique is the foundation of good practice; knowledge of underlying science may be persuasive.
- Regular education and training offers opportunities for healthcare workers to practice their skills, ask questions, and correct misunderstandings or bad habits in a comfortable, supportive environment.
- Immediate feedback in skills training allows for targeted correction of poor practice.
- Use of standardised indications and techniques ensures compliance with best practice.
- Attendance could be incentivised through continuous professional development credits, motivating healthcare workers to keep their skills up to date.

Challenges (What challenges might be encountered in implementing this intervention?)

- It is possible that staff will become fatigued with messaging about hand hygiene.
- Improving knowledge of hand hygiene does not guarantee improvement in practical skills; similarly, improving practical skills in a training session does not guarantee that staff members will be able or motivated to perform to the same standards on a real ward.
- Education and training can be very resource-intensive in terms of staff time, particularly 1:1 training. Frequent changeovers of staff and turnover of locum staff may make it challenging to ensure that all staff members are up to date with their training requirements.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required for train-the-trainer sessions, provision of education and training sessions, logistics, and record-keeping to ensure that staff are up to date with their training requirements.
- Other resources will be required to conduct sessions, e.g., printed materials, catering, meeting space, hand hygiene supplies.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
3	73.5	63.9	68.2	76.2	80.1	75.0	77.6

Stakeholder comments:

Generally positive; implementation details would be important, including timing and hands-on aspects. All professionals should receive training. Some concerns about intervention fatigue and demands on staff time.

Intervention Number 4: Continuous education through visual communications

Intervention function: Education/training- increasing knowledge or understanding/imparting skills.

Intervention description (What does the intervention involve?)

In this intervention, continuous reinforcement of the hand hygiene message is provided through printed materials and multimedia. Some components of this programme may include the following:

- Use of visual reminders and cues on the ward, such as posters, banners, gadgets, stickers and screensavers.
- Use of stripes and mirrors to increase awareness of the patient zone.
- Varying visual reminders over time so that they stay fresh in people's minds.
- Providing pocket guides and leaflets / brochures to reinforce training.
- Prominent display of educational notices and correct hand hygiene procedures.
- Translation of all visual media into relevant languages.
- Use of promotional t-shirts, videos, banners, stands and a logo to promote hand hygiene campaigns.

Strengths (What are the strengths associated with this intervention?)

- The ready availability of resources may allow healthcare workers to correct their own misunderstandings or brush up their knowledge without losing face or needing to seek help formally.
- Keeping hand hygiene visibly on the agenda at levels of senior management builds awareness and may help to normalise efforts to improve it.

Challenges (What challenges might be encountered in implementing this intervention?)

- It is possible that staff will become fatigued with messaging about hand hygiene.
- Improving knowledge of hand hygiene does not guarantee improvement in practical skills; similarly, improving practical skills in a training session does not guarantee that staff members will be able or motivated to perform to the same standards on a real ward.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to generate appropriate materials and rotate them on an ongoing basis.
- Financial resources will also be required for graphic design, printing and production.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
4	73.4	66.7	80.1	60.9	75.6	72.5	87.9

Stakeholder comments:

Mixed responses around affordability. Easy to implement, but some scepticism that visual materials quickly fade into the background.

Intervention Number 5: Peer-to-peer accountability and support

Intervention function: Enablement-increasing means or reducing barriers to increase capability, or opportunity.

Intervention description (What does the intervention involve?)

Hand hygiene campaigns require more than physical resources and adequate staff knowledge to be successful; a social environment on the ward that encourages compliance is also essential to allow healthcare workers to put their knowledge into practice. In this intervention, focus is placed on developing a supportive environment in the unit, in which peers are encouraged and empowered to support one another in good hand hygiene practices, to actively educate one another, to remind their peers of hand hygiene, and to discuss instances where staff don't practice hand hygiene and the reasons why. Friendly reminders and feedback between peers are encouraged and normalised through brief training sessions and posters, role models are appointed, posters are placed in the ward, and poor hand hygiene practice is addressed in a way that is kind and supportive, rather than punitive.

Strengths (What are the strengths associated with this intervention?)

- Healthcare workers within different professional groups know the unique challenges their group faces and can help to mentor their peers in dealing with these challenges.
- Mutual support fosters a sense of camaraderie among staff and can create positive feelings around hand hygiene – everyone is on the same team.
- Staff can receive feedback in real time about their hand hygiene performance, helping them to identify specific challenges for their own practice and take steps to improve.

- Misunderstandings or lack of knowledge about proper hand hygiene practice can be identified and addressed.
- This approach can help to distribute the work of improving hand hygiene, highlighting the fact that responsibility for hand hygiene belongs to everyone, not only a designated infection control team.

Challenges (What challenges might be encountered in implementing this intervention?)

- Some staff may be uncomfortable that their behaviour is being monitored and commented on by their peers; they may feel scrutinised, criticised or "nagged".
- Similarly, if supportive comments are not well-received or a negative atmosphere develops around the intervention, there is the potential for resentment among colleagues and for ill feeling towards efforts to improve hand hygiene.
- Hierarchy may prove to be an obstacle, if senior staff are reluctant to "correct" the behaviour of very established colleagues.
- Staff shortages or time pressure may limit opportunities for thoughtful engagement between members of staff around hand hygiene.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to provide initial training for staff on mutual support, and to update training over time as required. This training may also require other resources (e.g., information packs, meeting space).
- Some funding will be required for posters.
- Staff, particularly appointed role models for this intervention, will need to devote some of their time each day to offer feedback and support to their colleagues.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
5	72.5	76.7	75.0	76.8	66.9	56.2	84.0

Stakeholder comments:

Potential to be effective, but difficult to do well; potential to create resentment or poor staff morale if individuals feel unfairly targeted. Culture on the ward would be important; psychological safety vs blame culture.

Intervention Number 6: Monitoring and feedback at unit level

Intervention function: Persuasion- using communication to induce positive or negative feelings or stimulate action.

Intervention description (What does the intervention involve?)

In this intervention, hand hygiene is monitored and feedback is provided to staff at the unit level. Unit-level performance metrics are publicly displayed and fed back to staff on the unit. Summary reports are provided for supervisors and chiefs of services to alert them to good performance and any possible issues. Hand hygiene is included in discussions at relevant committee meetings and kept on the agenda. Inter-site or inter-unit comparisons / rankings are provided to give context for unit performance.

Strengths (What are the strengths associated with this intervention?)

- Continuous discussion of hand hygiene keeps it on the agenda and encourages continuous improvement.
- Unit-level feedback and comparisons may foster a sense of camaraderie among staff – everyone is on the same team.
- This approach can help to distribute the work of improving hand hygiene, highlighting the fact that responsibility for hand hygiene belongs to everyone, not only a designated infection control team.

- Staff may be encouraged in their efforts if they see sustained good performance or improved performance over time in their own units.
- This approach allows areas with poor performance to be identified, so that resources can be targeted to address specific challenges.
- An increased sense of accountability to patients, management and fellow team members may encourage greater diligence for individual staff members.

Challenges (What challenges might be encountered in implementing this intervention?)

- Monitoring hand hygiene and publishing findings on an ongoing basis is resource- and time-intensive.
- The Hawthorne effect, whereby people change their behaviour when they know they are being monitored, may lead to observed compliance levels that are higher than the real compliance level day-to-day on the ward.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required for training observers, carrying out monitoring, delivering feedback and compiling results.
- Administrative support for record-keeping may also be required.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
6	71.2	67.9	75.8	70.7	70.3	65.8	76.1

Stakeholder comments:

Monitoring creates a stressful environment for staff. Has been effective in some units. Clarity is important when publishing data.

Intervention Number 7: Ongoing / top-up education and training

Intervention function: Education/ training- increasing knowledge or understanding/imparting skills.

Intervention description (What does the intervention involve?)

In this intervention, top-up education and training is actively provided on a continuous basis, on a schedule that suits the needs of the unit (monthly, quarterly, etc.)

Strengths (What are the strengths associated with this intervention?)

- Top-up training helps to keep skills and knowledge fresh for staff, and offers the opportunity to correct misunderstandings or bad habits.
- Continuous training keeps hand hygiene visibly on the agenda for both frontline staff and management.

Challenges (What challenges might be encountered in implementing this intervention?)

- It is possible that staff will become fatigued with messaging about hand hygiene.
- Continuous top-up training may be very resource-intensive in terms of staff time.
- Frequent changeovers of staff and turnover of locum staff may make it challenging to ensure that all staff members are up to date with their training requirements.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required for train-the-trainer sessions, provision of education and training sessions, logistics, and record-keeping to ensure that staff are up to date with their training requirements.
- Other resources will be required to conduct sessions, e.g., printed materials, catering, meeting space, hand hygiene supplies.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
7	70.5	68.5	68.8	70.7	68.3	67.2	79.7

Stakeholder comments:

Brief top-up sessions are valuable. Some concerns expressed about intervention fatigue / resentment with high frequency of sessions.

Intervention Number 8: Tailored education and training for professional groups

Intervention function: Education/ training- increasing knowledge or understanding/imparting skills.

Intervention description (What does the intervention involve?)

In this intervention, educational sessions are segregated by professional group. Professional groups face different challenges in delivering care, and may conceptualise their roles in different ways. In this intervention, the members of staff responsible for delivering education and training take these differences into account and tailor their material appropriately, to ensure that it is of maximum relevant to the specific audience.

Strengths (What are the strengths associated with this intervention?)

- This approach addresses the unique working challenges and priorities of each group in a targeted way.
- Many educational programmes are already segregated by professional group, so this intervention fits within that model.
- Gathering as a group to discuss hand hygiene issues may encourage peer support and open sharing of difficulties and strategies to overcome them.

- Professional groups may differ in the level of education about hand hygiene they have received in the past; therefore, training sessions with mixed groups may be less effective than segregated groups.

Challenges (What challenges might be encountered in implementing this intervention?)

- Additional resources are required to tailor interventions to different groups and deliver separate sessions.
- The unique challenges and working conditions of individual groups must be properly understood in advance to ensure effective tailoring of the intervention.
- This approach does not support whole-team working with members of different professional groups, which is of critical importance.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required for provision of education and training sessions, logistics, and record-keeping to ensure that staff are up to date with their training requirements.
- Other resources will be required to conduct sessions, e.g., printed materials, simulation supplies.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
8	70.4	64.2	68.4	73.7	73.3	64.2	78.8

Stakeholder comments:

Mixed response; some acknowledgement that different groups have different challenges, but general scepticism that the principles are fundamentally different across groups and that undermining a multidisciplinary approach is worth it.

Intervention Number 9: Support for improving the local institutional safety culture

Intervention function: Environmental restructuring- changing the physical or social context.

Intervention description (What does the intervention involve?)

The institutional safety culture refers to the norms, values and basic assumptions about safety within the healthcare organisation. In this intervention, healthcare workers seeking to promote hand hygiene proactively create and foster a positive institutional safety culture on a broader level. The commitment of executives and representatives of professional groups is secured, and at ward level, challenges, opportunities and champions are identified. Infection control and hand hygiene are promoted as a priority at every level of the organisation.

Strengths (What are the strengths associated with this intervention?)

- This approach embeds hand hygiene within a patient-centred safety culture with commitment at all levels to protecting patients and improving care.
- Staff at all levels of the organisation can be engaged to inform the change process.

Challenges (What challenges might be encountered in implementing this intervention?)

- Influencing institutional culture is a complex task, and efforts to improve culture around hand hygiene and other safety issues may only take effect over a long period of time.
- Research on effective means to improve safety culture is still developing.
- Improving institutional safety culture at a broad level requires substantial expertise and financial investment.
- Hand hygiene, while of critical importance, is only one part of safety culture and may not receive a great deal of attention in a broader programme to improve institutional safety culture.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to determine appropriate targets for improvement efforts and to develop and implement action plans.
- Some investment of finances, resources and time will be required to monitor the programme and measure the outcomes.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
9	70.3	64.3	71.8	66.6	73.9	67.0	78.0

Stakeholder comments:

Potential to improve patient outcomes, but significant time investment required. Some comments that this intervention is not concerned with practice on the ground - "meaningless bit of jargon", "buzz words".

Intervention Number 10: Inclusion of hand hygiene behaviour in all procedural protocols

Intervention function: Restriction-using rules to reduce the opportunity to engage in the target behaviour.

Intervention description (What does the intervention involve?)

In healthcare, a protocol is a document that describes the appropriate actions to take in particular situations; for example, how to diagnose, treat and care for a patient with a specific condition, procedures to stop the spread of infection, or how to report on important events. In this intervention, guidelines for hand hygiene are included in any relevant protocols, with full information on necessary equipment, techniques, ward setup, mandatory training, and auditing practices. The relevant staff are also encouraged to read and adhere to the updated protocols, latest developments and best practices.

Strengths (What are the strengths associated with this intervention?)

- This approach incorporates hand hygiene into all activities and procedures on the ward in an explicit, detailed way.
- It also provides clarity on times when hand hygiene is necessary, information on the necessary equipment, and instructions on how to complete hand hygiene appropriately.

- Inclusion of hand hygiene in protocols demonstrates commitment to hand hygiene by hospital leadership and makes expectations clear for all staff.

Challenges (What challenges might be encountered in implementing this intervention?)

- It isn't clear that protocol guidelines have a strong impact on behaviour, or that protocols are frequently consulted or used in real practice at ward level.
- Subject matter experts in both hand hygiene and the relevant procedural protocols will need to collaborate closely in order to ensure that hand hygiene instructions are incorporated in a seamless way into existing documents.
- Protocols may not exist for all procedures.

Cost (What resources might be needed to implement this intervention?)

- Updating protocols is likely to require a significant time commitment from relevant staff over an extended period of time.
- Some funding will also be required for reprints of protocols where necessary.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
10	70.3	69.2	78.4	54.0	71.2	69.9	79.3

Stakeholder comments:

Generally negative comments; consensus that protocols and paperwork don't impact real-world practice, especially with staff rotations.

Intervention Number 11: Implementation of universal contact precautions during outbreaks of serious infectious illness

Intervention function: Restriction-using rules to reduce the opportunity to engage in the target behaviour.

Intervention description (What does the intervention involve?)

Aside from usual hand hygiene practice, safe disposal of sharps, and other standard precautions to prevent spread of infection, additional contact precautions are recommended to be used when caring for a patient who is known or suspected to be affected by some specific infectious diseases (such as Clostridium difficile infection, norovirus, or antibiotic-resistant infections). These additional contact precautions may include use of disposable glove and plastic aprons for all direct contacts with the patient, use of single rooms where available, additional cleaning of the room and deep cleaning upon the patient's transfer / discharge, and additional hygiene measures while transporting the patient. In this intervention, these additional contact precautions are implemented for all patients in intensive care unit when an outbreak of serious infectious illness occurs.

Strengths (What are the strengths associated with this intervention?)

- This intervention may be appropriate during outbreaks of serious illness, as it may reduce the likelihood of serious infections spreading on the ward.
- Patients and their families may be reassured that staff are taking extra measures to reduce the spread of infections.

Challenges (What challenges might be encountered in implementing this intervention?)

- This is a very conservative and resource-intensive approach to infection prevention.
- Not all ICU wards will be able to support this intervention (e.g., if single rooms are not available).
- The intervention places increased demands on staff, which can lead to poor compliance and less time to spend with patients.
- Additional contact precautions can be anxiety-provoking for patients and evoke feelings of stigma.

Cost (What resources might be needed to implement this intervention?)

- Implementation of additional contact precautions will require additional physical supplies (gloves, gowns, etc.).
- Additional contact precautions will also require staff time to carry out extra actions, co-ordinate transport of patients to single rooms, and monitor compliance as appropriate.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
11	69.9	60.1	70.3	76.9	78.5	62.9	69.6

Stakeholder comments:

Already in place in some units, particularly with COVID-19. Significant demands on resources, not always possible to adhere.

Intervention Number 12: Screening and identification of patients carrying MRSA and other “superbugs”

Intervention function: Persuasion- using communication to induce positive or negative feelings or stimulate action.

Intervention description (What does the intervention involve?)

In this intervention, patients are screened on admission to determine whether they are carriers of “superbugs”, such as MRSA (Methicillin-Resistant Staphylococcus Aureus) and other pathogens that may cause infections that are difficult to treat and likely to spread to other patients. If a patient is identified as a carrier of a pathogen like MRSA, all relevant staff may be notified and additional precautions may be taken to ensure that it is not spread to other patients in the unit.

Strengths (What are the strengths associated with this intervention?)

- Staff may feel a heightened sense of urgency around hand hygiene where a clear, high risk of serious infection has been identified.
- Employing additional precautions only for affected patients, rather than employing them for all patients on the ward, reduces the demands on staff time and resources.

Challenges (What challenges might be encountered in implementing this intervention?)

- Efforts to practice hand hygiene efforts must be employed consistently; not only with certain patients or under certain conditions. Having no patients identified as carriers of dangerous pathogens may induce a false sense of security
- Patients may feel stigmatised if they are clearly designated as needing additional precautions due to their status as carriers.

Cost (What resources might be needed to implement this intervention?)

- Screening for pathogens will require investment of resources and staff time for collection of samples, testing, and posting of results, as well as communication of the results to the relevant staff.
- Implementation of additional contact precautions for affected patients will require additional physical supplies (gloves, gowns, etc.) as well as staff time to carry out contact precautions, co-ordinate transport of patients to single rooms, and monitor compliance as appropriate.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
12	69.3	63.4	70.8	73.6	76.4	56.1	76.0

Stakeholder comments:

Already practiced in some ICUs. May imply that hand hygiene is not equally important for all patients. Cost implications may be significant.

Intervention Number 13: Consultation with frontline staff about hand hygiene improvement

Intervention function: Incentivisation- creating an expectation of reward.

Intervention description (What does the intervention involve?)

In this intervention, action plans for hand hygiene improvement are developed based on staff feedback. Staff are consulted through focus groups, interviews, or feedback sessions about barriers to hand hygiene compliance, reasons for poor performance, appropriate and realistic targets, contingency planning, and what individual staff members and unit leadership can do to improve hand hygiene. Cooperation and support for new initiatives is sought during the planning stages, placing staff feedback at the heart of the process.

Strengths (What are the strengths associated with this intervention?)

- Factors that influence the success of an intervention are not always obvious from the outside. Frontline staff are most familiar with the environment and its unique challenges, and can provide critical insight into how an intervention may really work in practice.
- By placing staff consultation at the heart of the planning process, an intervention can implement local solutions at the local level, tailoring the intervention to address the specific needs of a hospital or a unit.
- Involvement in the intervention design process may promote a sense of camaraderie, and increase staff engagement with hand hygiene and motivation to comply with guidelines.
- This approach can be incorporated into any type of intervention.

Challenges (What challenges might be encountered in implementing this intervention?)

- The consultation process may be lengthy and costly. It also requires particular expertise; focus groups/interviews should be conducted in an efficient manner and the data collected must be analysed and protected appropriately.
- Similarly, staff in charge of developing or designing interventions and action plans must have appropriate knowledge of the existing research in the area and what scientific support, if any, exists for different intervention options.
- People sometimes have poor insight into their own behaviour and why they do or do not engage in certain practices; as such, staff insight into why they do or do not engage in hand hygiene at appropriate times may not fully capture the real reasons for their behaviour.
- Care must be taken when discussing reasons for not performing hand hygiene or barriers to compliance. It is important that an accusatory or blaming tone does not develop around the conversation and that negative associations with hand hygiene are not promoted.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to engage frontline staff in the process, co-ordinate and conduct focus groups / interviews, and analyse the data.
- Some other resources may be required to conduct focus groups / interviews, e.g., printed materials, catering, meeting space.
- Some training may be required to ensure that the consultation process is run effectively (e.g., training staff in how to properly conduct focus groups / interviews).

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
13	68.9	59.3	63.8	78.0	78.1	62.5	72.3

Stakeholder comments:

Mixed response; some responses that staff should be included and consulted, others that minimal insight would be gained.

Intervention Number 14: Simulation training for hand hygiene

Intervention function: Education/training- increasing knowledge or understanding/imparting skills.

Intervention description (What does the intervention involve?)

In simulation, healthcare workers are given an opportunity to practice skills in an educational, supportive environment using mannequins, artificial models, virtual / augmented reality technology, and actors or simulated patient interactions. In this intervention, simulation sessions are held with various unit-appropriate scenarios set up for healthcare workers to practice hand hygiene. They are provided with full debriefing after the session to maximise learning, including discussions of the proper times to perform hand hygiene and proper techniques. The effectiveness of their handwashing / handrub technique can be checked using UV light equipment, if available.

Strengths (What are the strengths associated with this intervention?)

- Simulation offers comprehensive hand hygiene instruction in an environment that more closely matches the real ward than a classroom or workshop setting. This may improve the likelihood of the learning being transferred to the real environment.
- Staff can receive feedback in real time about their hand hygiene performance, helping them to identify specific challenges for their own practice and take steps to improve.

- Misunderstandings or lack of knowledge about proper hand hygiene practice can be identified and addressed.
- This intervention can be folded into other educational programming and can address multiple learning objectives at once (e.g., hand hygiene can be a special focus during a simulation to train healthcare workers to carry out particular procedures or respond to particular emergencies).

Challenges (What challenges might be encountered in implementing this intervention?)

- Simulation is highly resource-intensive, in terms of both supplies and staff time to set up and deliver simulation training.
- Frequent changeovers of staff and turnover of locum staff may make it challenging to ensure that all staff members have an opportunity to receive simulation training.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required for provision of education and training sessions, logistics, and record-keeping to ensure that staff are up to date with their training requirements.
- Other resources will be required to conduct sessions, e.g., printed materials, simulation supplies.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
14	67.6	51.8	65.8	79.9	75.6	70.5	62.0

Stakeholder comments:

Generally popular, particularly feedback in situ and demonstrations with UV lightboxes. Access to facilities, resourcing, and demands on staff time make this challenging “but not impossible”.

Intervention Number 15: Proactive corrective action

Intervention function: Coercion- creating an expectation of punishment or cost.

Intervention description (What does the intervention involve?)

In this intervention, senior staff proactively take and record corrective action for healthcare workers whose compliance is unsatisfactory. This corrective action may take the form of additional education, clarification of misunderstandings or doubts, positive reinforcement of good hand hygiene practice, and efforts to modify poor habits. In more serious cases, or where non-compliance is a recurring problem, disciplinary action or sanctions may be considered. Crucially, a standardised process for recording corrective action in a specific form is implemented so that patterns may be identified.

Strengths (What are the strengths associated with this intervention?)

- This intervention specifically targets staff most in need of improvement.
- The intervention may provide an incentive for staff to be diligent in their hand hygiene practice.
- The intervention also demonstrates support for hand hygiene efforts from senior staff.

Challenges (What challenges might be encountered in implementing this intervention?)

- It may be challenging to define what constitutes poor performance.

- This intervention may unfairly target staff who work in more challenging environments, where it is difficult to adhere to hand hygiene due to the physical layout of the ward, frequency of emergencies, or other factors.
- Similarly, the intervention may be perceived as punishing those most in need of support.
- The fairness of this approach relies on high quality, reliable monitoring of performance.
- This approach may encourage staff to hide poor performance rather than seek help.
- Staff whose performance is deemed poor may feel exposed or embarrassed.
- Similarly, if the intervention is perceived as being punitive or a negative atmosphere develops around the intervention, there is the potential for resentment among colleagues and for ill feeling towards efforts to improve hand hygiene.
- Hierarchy may prove to be an obstacle, if senior staff are reluctant to “correct” the behaviour of very established colleagues.
- The person or people implementing this intervention must be carefully selected for the right personal qualities; they should be well-respected, approachable and encouraging of their peers, while still in a position of sufficient authority.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to carry out monitoring and corrective actions (e.g., additional education).
- Administrative support for record-keeping may also be required.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
15	66.7	76.6	72.2	68.0	52.9	51.7	77.6

Stakeholder comments:

Use of fear can be effective, but feeling watched is unsettling in an environment that is already stressful. Difficult for senior staff to implement in a supportive way. Would be important to make expectations clear at the outset and to have a fair approach to all professional groups.

Intervention Number 16: Competitions, prizes and rewards

Intervention function: Incentivisation-creating an expectation of reward.

Intervention description (What does the intervention involve?)

In this intervention, individual staff members and units are given material rewards for satisfactory compliance and for reaching compliance targets at unit level. These rewards may take the form of coffee, lunch, recognition ceremonies, or other incentives deemed appropriate at the local level. Alternatively, friendly competitions may be hosted between units, with prizes for units and top individual performers.

Strengths (What are the strengths associated with this intervention?)

- Friendly competition can create a sense of camaraderie at unit level and create positive associations with hand hygiene.
- Staff may be encouraged in their efforts if they see sustained good performance or improved performance over time in their own units.

Challenges (What challenges might be encountered in implementing this intervention?)

- This intervention requires staff buy-in and regular monitoring of compliance.
- Identifying rewards that will be valued by all staff members may be difficult.
- There is the potential for discouragement in units with specific challenges or where compliance is poor.
- It is possible that individual team members with poor performance may be perceived by team members as “dragging down” the performance of the unit as a whole.
- Units and individuals with poor performance must be provided with corrective feedback, so that they have the opportunity to improve.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to secure buy-in and monitor compliance to determine performance.
- Some financial investment will be required to fund prizes / rewards.
- Some staff time will also be required to host recognition ceremonies, prize-givings, and other announcements arising from the intervention.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
16	66.2	61.8	70.9	65.7	67.7	56.6	75.3

Stakeholder comments:

Mixed response; recognition is important, but prizes are unlikely to be effective motivators and the optics could be damaging.

Intervention Number 17: Get staff feedback on the alcohol hand gel to be made available in units for hand cleansing

Intervention function: Enablement-increasing means or reducing barriers to increase capability, or opportunity.

Intervention description (What does the intervention involve?)

In this intervention, staff input is solicited to inform the choice of alcohol hand gel to be made available in units for hand cleansing. Different types of gel are trialled on wards; this could take the form of ‘taster sessions’ where staff can sample a range of gels at a time, or where each gel is used on the ward for an appropriate period (e.g., one day, one week, etc.) to allow staff to sample it over the course of a real working day. Staff feedback is then solicited through brief interviews, comment cards, or other appropriate means. This feedback is taken into account when selecting the gel to be purchased and used on the ward.

Strengths (What are the strengths associated with this intervention?)

- This approach acknowledges both the effectiveness and acceptability of hand gel options; a gel is only effective in real practice if staff are willing to use it.
- Involvement in the process may increase staff engagement with hand hygiene and awareness of the issues.

- Input into the procurement process may help to create a sense of camaraderie between clinical and non-clinical staff groups; this is a decision that impacts on daily practice and can be made in consultation with frontline staff.

Challenges (What challenges might be encountered in implementing this intervention?)

- The research process may be lengthy and costly.
- Many factors must be considered when making procurement decisions, not only staff feedback. There may be resistance to prioritising feedback over other considerations, such as cost.
- Similarly, staff may feel disregarded if their opinions are sought but ultimately not truly factored into a decision. For this reason, all hand gel options must be realistic choices that could feasibly be implemented.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to engage frontline staff in the research, set up the gels to be trialled (either in ‘taster sessions’ or in the usual ward environment), gather feedback about the options, and conduct the necessary analysis.
- Funding will also be required to provide gels for trial.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
17	65.4	56.5	72.9	58.2	69.2	65.5	68.3

Stakeholder comments:

General consensus that this wouldn’t be effective enough to be worth the cost and resources. Small minority believe that a feeling of ownership over decisions will promote compliance.

Intervention Number 18: Demonstrated support for hand hygiene from hospital leadership

Intervention function: Environmental restructuring- changing the physical or social context.

Intervention description (What does the intervention involve?)

In this intervention, hospital directors, leaders and senior management provide a show of support for hand hygiene efforts and participate in monthly executive walkarounds. Hospital leaders emphasise the importance of hand hygiene for patient safety, the status of current performance, and public commitment to improve, and participate in events to launch or promote improvement efforts. The support of directors and senior staff is demonstrated through visual displays in public areas, showing signed statements of support, results of audits, photos of staff, etc.

Strengths (What are the strengths associated with this intervention?)

- The commitment of leadership may have a positive ‘trickle-down’ effect, inspiring others in the organisation to adopt hand hygiene as a priority.
- Commitment to improving hand hygiene at senior levels may allow for increased investment of funding and other resources in efforts to improve hand hygiene, smoothing the way for future interventions.

- Keeping hand hygiene visibly on the agenda at levels of senior management builds awareness and may help to normalise efforts to improve it.

Challenges (What challenges might be encountered in implementing this intervention?)

- It may be difficult to access busy senior management staff and justify the use of their time for this intervention.
- Messages about hand hygiene from non-clinical staff must be appropriately sensitive to the perspectives and experiences of front-line clinical staff so as not to appear out-of-touch.

Cost (What resources might be needed to implement this intervention?)

- The directors and senior management staff involved will need to devote some of their time to the intervention to promote hand hygiene and participate in events / walkarounds.
- Some funding will be required for posters and other visual displays.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
18	64.9	69.1	72.1	52.8	62.1	60.7	72.3

Stakeholder comments:

Mixed responses on appropriateness; buy-in from management is important but overt displays may be seen as “nagging” if the relationship is poor. Sensitivity to clinical context would be vital. Walkaround aspect generally unpopular; footfall through ICU should be kept to a minimum.

Intervention Number 19: Monitoring and feedback for individual staff members

Intervention function: Persuasion- using communication to induce positive or negative feelings or stimulate action.

Intervention description (What does the intervention involve?)

In this intervention, hand hygiene is monitored and feedback is provided to staff at an individual level. Their hand hygiene behaviour is monitored by a trained observer over a period of time, and the observer provides feedback on their performance and advice on specific areas that may need improvement. In particular, feedback may be delivered in the moment as the staff member is working at the bedside, so that poor habits or non-compliance can be immediately corrected.

Strengths (What are the strengths associated with this intervention?)

- Immediate feedback to individual staff members allows for targeted correction of behaviour.
- Continuous discussion of hand hygiene keeps it on the agenda and encourages continuous improvement.
- This approach can help to distribute the work of improving hand hygiene, highlighting the fact that responsibility for hand hygiene belongs to everyone, not only a designated infection control team.
- Staff may be encouraged in their efforts if they see sustained good performance or improved performance over time in their own practice and in their units.

- This approach allows areas with poor performance to be identified, so that resources can be targeted to address specific challenges.

Challenges (What challenges might be encountered in implementing this intervention?)

- Monitoring hand hygiene one-to-one on an ongoing basis is resource- and time-intensive.
- The Hawthorne effect, whereby people change their behaviour when they know they are being monitored, may lead to observed compliance levels that are higher than the real compliance level day-to-day on the ward.
- Some staff may be uncomfortable that their behaviour is being monitored and commented on; they may feel scrutinised, criticised or “nagged”.
- Similarly, if feedback is not well-received or a negative atmosphere develops around the intervention, there is the potential for resentment among colleagues and for ill feeling towards efforts to improve hand hygiene.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required for training observers, carrying out monitoring, delivering feedback and compiling results.
- Administrative support for record-keeping may also be required.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
19	60.2	56.2	61.6	71.7	51.6	53.8	65.1

Stakeholder comments:

Concerns about Hawthorne effect impacting results and discomfort with being observed at work. Significant resource implications, may lead to resentment among peers.

Intervention Number 20: Warning letters

Intervention function: Coercion- creating an expectation of punishment or cost.

Intervention description (What does the intervention involve?)

In this intervention, a warning letter is issued when an individual staff member is repeatedly noted to be negligent in complying with hand hygiene guidelines. The letter may be issued by a designated leader within their professional group or another appropriate authority. This may form part of a stepped approach (e.g., a letter is issued following verbal warnings).

Strengths (What are the strengths associated with this intervention?)

- This intervention specifically targets staff most in need of improvement.
- The intervention may provide an incentive for staff to be diligent in their hand hygiene practice.
- The intervention also demonstrates support for hand hygiene efforts from senior staff.

Challenges (What challenges might be encountered in implementing this intervention?)

- It may be challenging to define what constitutes poor performance.
- This intervention may unfairly target staff who work in more challenging environments, where it is difficult to adhere to hand hygiene due to the physical layout of the ward, frequency of emergencies, or other factors.

- Similarly, the intervention may be perceived as punishing those most in need of support.
- The fairness of this approach relies on high-quality, reliable monitoring of performance.
- This approach may encourage staff to hide poor performance rather than seek help.
- Staff whose performance is deemed poor may feel exposed or embarrassed.
- Similarly, if the intervention is perceived as being punitive or a negative atmosphere develops around the intervention, there is the potential for resentment among colleagues and for ill feeling towards efforts to improve hand hygiene.
- Hierarchy may prove to be an obstacle, if senior staff are reluctant to "correct" the behaviour of very established colleagues.
- The person or people implementing this intervention must be carefully selected for the right personal qualities; they should be well-respected, approachable and encouraging of their peers, while still in a position of sufficient authority.

Cost (What resources might be needed to implement this intervention?)

- Staff time will be required to carry out monitoring and issue warnings.
- Administrative support for record-keeping may also be required.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
20	59.1	71.0	71.5	54.7	41.4	39.4	75.7

Stakeholder comments:

General consensus that this has potential to create a negative environment and to be upsetting and highly inequitable. Mixed views on whether it would be effective.

Intervention Number 21: Hand hygiene breaks

Intervention function: Environmental restructuring- changing the physical or social context.

Intervention description (What does the intervention involve?)

In this intervention, regular breaks for hand hygiene are scheduled. At the appointed times, all staff on the ward pause their work, where it is safe to do so, and thoroughly wash their hands. The break may be signalled by an automated bell, and the campaign may be promoted by senior staff and poster prompts.

Strengths (What are the strengths associated with this intervention?)

- A group exercise with all staff engaging in the same practice at once could build camaraderie and reinforce compliance.
- Clearly scheduled opportunities for hand hygiene reinforce its importance and demonstrate commitment to good practice.
- Patients may be reassured by the staff's visible, collective commitment to good hand hygiene practice.

Challenges (What challenges might be encountered in implementing this intervention?)

- Breaks may not be appropriate in all settings (e.g., ICU where acute / emergency situations arise regularly).
- Consultants or visiting staff may not have the opportunity to take part in scheduled breaks.
- Breaks may cause interruptions to patient care or disrupt patients and their visitors.
- Scheduled breaks may negatively impact commitment to hand hygiene outside of these breaks.

Cost (What resources might be needed to implement this intervention?)

- Some funding may be required for posters and other promotional materials, along with the usual costs of hand hygiene supplies.

Rank	Overall	Affordability	Practicability	Effectiveness	Acceptability	Side effects	Equity
21	53.9	77.0	37.2	53.1	44.5	39.4	65.4

Stakeholder comments:

Some support, but many concerns about side-effects: practicality of implementing this in a busy ICU, interruptions to patient care, concern that 5 moments would not be adhered to.

