



**An Roinn Sláinte**  
Department of Health

## **Using Behavioural Science to Improve Hand Hygiene in Workplaces and Public Places**

A Department of Health Research Working Paper prepared on behalf of the COVID-19 NPHET Subgroup – Behavioural Change

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The views in this report are those of the author and not necessarily those of the Minister for Health nor the Department of Health.

## TABLE OF CONTENTS

Executive Summary .....	i
Introduction .....	1
1. Ensure awareness of the benefits of and techniques for good hand hygiene .....	1
2. Provide visual cues in restrooms to remind people to wash and dry hands .....	6
3. Ensure that hand sanitisers are available, visible and easy to use .....	15
4. Model good behaviours, help staff to form good habits and provide regular feedback .....	25
5. Combine multiple actions to maximise compliance with good HH .....	29
References .....	32
Methods .....	37

## Citation

Please cite this report as:

Murphy, R., (2020). *Using Behavioural Science to Improve Hand Hygiene in Workplaces and Public Places*, Research Services and Policy Unit, Department of Health.

## Acknowledgements

The author would like to thank Dr Aileen McGloin, Director of Marketing and Communications at *safefood* for providing feedback on the draft report. The author bears sole responsibility for interpretation and analysis.

## EXECUTIVE SUMMARY

Good hand hygiene is a very important way of preventing the spread of COVID-19. However, people find it difficult to consistently achieve good hand hygiene.

The purpose of this paper was to identify practical actions that could be scaled nationally in workplaces and public facilities to help increase good hand hygiene practice, and to package these under a small number of approaches.

This paper provides insights from behavioural science, drawing on behaviour change frameworks and findings from more than 40 real-world studies testing different approaches to improve handwashing or the use of alcohol-based hand sanitisers.

### **Five key approaches can be taken in workplaces to improve hand hygiene.**

1. Ensure awareness of the benefits of and techniques for good hand hygiene.
2. Provide visual cues in restrooms to remind people to wash and dry hands.
3. Ensure that hand sanitisers are available, visible and easy to use.
4. Model good behaviours, help staff to form good hand hygiene habits and provide regular feedback on performance.
5. Combine multiple actions (e.g. 1 to 4) to maximise compliance with good hand hygiene.

A list of **practical actions to implement these approaches** is provided on the next page, along with an indication of the evidence supporting these.

## Actions to Improve Hand Hygiene in Workplaces and Public Places

### 1. Ensure awareness of the benefits of and techniques for good hand hygiene

- Make people aware of the benefits of good hand hygiene.\*\*\*
- Make people aware that they/their family are probably not using the correct techniques.\*\*
- Show the required steps of handwashing: wet, lather, scrub for 20 seconds, rinse, dry for 20 seconds.\*\*\*
- Show the correct steps for applying hand sanitiser: apply the gel, rub hands, for 20 seconds rub all the surfaces until dry.\*

### 2. Provide visual cues in restrooms to remind people to wash and dry hands

- Provide visual reminders in restrooms such as:
  - a poster\*\*\* above the sink, on the back of stall doors and above urinals,
  - an automatic towel dispenser\*\* that presents a towel upon approach to the sink,
  - directional arrows from stalls to sinks\*\*,
  - audio-visual reminders\*\*.

### 3. Ensure that hand sanitisers are available, visible and easy to use

- Make hand sanitisers available when handwashing is not feasible.\*\*\*
- Place the location of hand sanitiser dispensers at convenient points to maximise use.
  - In the direct routes that people walk\*\*\*, e.g. at the centre of an entrance lobby.
  - Within easy reach\*\*\*, e.g. on carts as well as walls, at the entrance to rooms.
  - Before and after tasks are completed\*, e.g. the entrance / exist of a shop or room
  - Where people normally pause\*, e.g. at an elevator.
- Ensure that signage for hand sanitiser dispensers:
  - does not limit access to the dispenser\*\*, e.g. is attached to it rather than in front of it,
  - keeps text to minimum\*, does not diminish the presence of visible dispensers.

### 4. Model good behaviours, help staff to form HH habits and provide regular feedback

- Managers, supervisors and influencers can model good behaviours\*\*\*.
- Provide regular performance feedback on compliance\*\*\*.
- Help staff link HH with common events\*, e.g. getting into work, the start of meetings.

### 5. Combine multiple actions (e.g. 1 to 4) to maximise compliance with good HH

\*\*\* = empirical evidence from 2+ studies, \*\* = empirical evidence from 1 study, \* = suggestive evidence only.

## Introduction

Good hand hygiene is a very important way of preventing the spread of COVID-19. However, people find it difficult to consistently achieve good hand hygiene. This working paper provides insights from behavioural science, drawing on behaviour change frameworks and findings from more than 40 real-world studies testing different approaches, to identify practical actions that could be scaled nationally to help increase good hand hygiene practice (see Appendix A for the methods).

### 1. Make staff aware of the benefits of and techniques for good hand hygiene

The framework for understanding behaviour which underpins the Behaviour Change Wheel (Michie, 2011) is based on a “behaviour system” whereby motivation, capability, and opportunity interact to generate behaviour. Motivation is defined as all those brain processes that energize and direct behaviour, whereas capability is defined as the individual’s psychological and physical capacity to engage in the activity concerned including having the necessary knowledge and skills. Most people, since childhood, have been told to “wash your hands” at key points (before eating food, after using the toilet) so it might not seem necessary to stress the benefits of good hand hygiene in response to COVID-19. Nevertheless, motivating people to do so and increasing capabilities by improving hand practices is very important.

It has been shown in controlled trials that routine hand hygiene removes viruses and bacteria from hands, and that handwashing with soap and water is the most effective method. A controlled trial which contaminated volunteers hands with the human influenza virus found that hand hygiene with soap and water (SW) or alcohol-based hand rub (ABHR) is highly effective in reducing influenza A virus on human hands, although SW is the most effective intervention (Grayson et al., 2009). Another controlled trial (Burton et al., 2011) that contaminated volunteers hands with faecal bacteria found that washing with plain soap (non-antibacterial soap) and water reduced the presence of bacteria by nearly three times as much as washing with water alone (presence of bacteria of 8% for using soap and water compared to 23%

for water alone). Official international guides recommend good hand hygiene as a way to decrease the transmission of pandemic influenza (WHO, 2017), and to limit the transit of COVID-19. The WHO (2020) has advised that “One of the most important contributions we can make to slowing down transmission of COVID-19 and keeping ourselves and our communities safe is to wash our hands.” The Centre for Disease Control and Prevention (CDC) “recommends washing hands with soap and water whenever possible because handwashing reduces the amounts of all types of germs and chemicals on hands. But if soap and water are not available, using a hand sanitizer with at least 60% alcohol can help you avoid getting sick and spreading germs to others.”

To achieve the benefits of good hand hygiene specific techniques, need to be followed. The Centre for Disease Control and Prevention (CDC) recommends the following five steps (the reason for each step is summarised below it):

1. Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.

Hands could become re-contaminated if placed in a basin of standing water that has been contaminated through previous use, so use clean running water (Palit, Batabyal, & Kanungo, 2012).

2. Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails.

Lathering and scrubbing hands creates friction, which helps lift dirt, grease, and microbes from skin. All surfaces of the hand and under the nails, so the entire hand should be scrubbed (Gordin et al., 2007; Hoque, 2003; Lin et al., 2003; McGinley, Larson & Leyden, 1988; Todd, Michaels, Smith, Greig & Bartleson, 2010).

3. Scrub your hands for at least 20 seconds. Need a timer? Hum the "Happy Birthday" song from beginning to end twice.

Evidence suggests that washing hands for about 15-30 seconds removes more germs from hands than washing for shorter periods (Todd, Michaels, Smith, Greig & Bartleson, 2010; Fuls et al., 2008; Jensen, Schaffner, Danyluk & Harris, 2012).

#### 4. Rinse your hands well under clean, running water.

Soap and friction help lift dirt, grease, and microbes—including disease-causing germs—from skin so they can then be rinsed off hands. Rinsing the soap away also minimizes skin irritation (Todd, Michaels, Smith, Greig & Bartleson, 2010). Because hands could become re-contaminated if rinsed in a basin of standing water that has been contaminated through previous use, clean running water should be used (Palit, Batabyal, & Kanungo, 2012; Hoque, 2003).

#### 5. Dry your hands using a clean towel or air dry them [use a dryer].

Germs can be transferred more easily to and from wet hands; therefore, hands should be dried after washing (Todd, Michaels, Smith, Greig & Bartleson, 2010; Patrick, Findon & Miller, 1997). The CDC notes that “Accordingly, many countries and global organizations have adopted recommendations to wash hands for about 20 seconds (some recommend an additional 20-30 seconds for drying)”.

In practice there are six steps, the 1<sup>st</sup> step is to ensure clothing is not at the wrists (i.e. to pull back ones sleeves if wearing long sleeves). This step is implicit in CDC guidance as (a) Step 2 requires getting soap and water at the wrists and (b) photos that accompany written guidance (and demonstration videos) show the hand washer with their sleeves rolled up (past the elbow or at a point between the wrist and elbow) or wearing short sleeves.

The CDC recommends the following techniques when using ABHS:

1. Apply the gel product to the palm of one hand (read the label to learn the correct amount).
2. Rub your hands together.
3. Rub the gel over all the surfaces of your hands and fingers until your hands are dry. This should take around 20 seconds.

Although good hand hygiene can be achieved at low cost, in terms of materials and time, and provides substantial benefits people do not consistently achieve good hand hygiene. A study found faecal bacteria on the hands of 3 out of every 10 commuters (28%) across five cities in the UK in 2008 (Judah, 2008). An online survey of consumers on the island of Ireland in 2015 (Dean, Foddai & Grant, 2017) found that despite the knowledge and awareness of the importance of washing hands, people generally reported poor HH behaviours; 3 out of ten (29%) report they frequently (3 plus times a day) wash their hands with water only, 9 out of ten (87%) report that when washing they do so for less than the recommended 20 seconds, and 3 out of ten (33%) report that they did not always dry their hands after handwashing. A lack of good hand hygiene still prevails, even at the time that handwashing advice to protect against COVID-19 was being given. A forthcoming observation study (Vaganay Miller & Lawson, forthcoming) finds inadequate handwashing by more than 8 out of every ten people (83%) in a public toilet in Belfast in March 2020 (i.e. not washing or drying, or not doing so for the adequate time).

The above points to the importance of increasing awareness of the benefits of good hand hygiene and the techniques to achieve good hand hygiene for staff and visitors to workplaces. A Cochrane systematic review (Gould 2017) of hand hygiene in patient care concluded there is evidence that education on hand hygiene practices improves hand hygiene compliance. This is based on two studies that met the review's inclusion criteria. A RCT examined an education sessions on hand hygiene (Huang, 2002) and it reported increases in the proportion of nurses in the intervention group who complied with recommendations for hand hygiene of 24.5 percentage points (for before patient contact, to 85.7%) and 16.3 percentage points compared to no changes or a decrease of 4.1 percentage points in the control group. An interrupted time series study (Higgins, 2013) reported an increase in hand hygiene compliance as a proportion of opportunities of 42 percentage points. Observed mean hand hygiene compliance in 12 months pre-e-learning game was 42% compared to 84% in the 12 months post-e-learning game.

An earlier systematic review of handwashing in healthcare workers (Nakioba & Hayward, 2001) concluded that “the effectiveness of educational interventions it



appears that they only have a short-term effect on handwashing behaviour. Compliance falls to low or baseline levels within a month.” This was based on the finding that (a) of the five studies found, four showed an increase in handwashing (Coignard, Grandbastien & Berrouane, 1998; Baker, 1998; Dubbert, Dolce, Richter, Miller & Chapman, 1990; Khatib, Ghassan, Abdallah, & Ibrahim, 1999) but one did not (Gould & Chamberlain, 1997) and (b) of the four studies that showed an increase, at three weeks post intervention one study showed a return to baseline levels (Dubbert, Dolce, Richter, Miller & Chapman, 1990) and one showed a return to low levels (Khatib, Ghassan, Abdallah, & Ibrahim, 1999).

### **Key Messages - Hand Hygiene**

Good **hand hygiene kills bacteria and viruses**, and it can be achieved through washing hands with soap and water or by using alcohol-based hand rub, washing hands with soap and water is more effective than washing with water alone (Burton et al., 2011) and using soap and water is more effective than using alcohol-based hand rub (Grayson et al., 2009).

To achieve the benefits of good hand hygiene **specific techniques**, need to be followed. The steps are below, these assume a person is wearing short sleeves or if wearing long sleeves has pulled them back away from their wrists.

- ✓ Handwashing: 1. wet, 2. lather, 3. scrub for 20 seconds, 4. rinse, 5. dry for 20 seconds.
- ✓ ABHS: 1. apply the gel, 2. rub hands, 3. rub all the surfaces until dry (20 seconds).

People **frequently do not follow the techniques** of effective handwashing and do not achieve good hand hygiene.

- ✗ self-report and observational studies indicate that people commonly do not adhere to recommended handwashing behaviours. Non-adherence includes not washing hands, not using soap when washing with water, not washing for long enough, not drying their hands after washing, or not drying for long

enough. (Dean et al., 2017; Vaganay et al., forthcoming)

- ✘ faecal bacteria are commonly found on the hands of commuters. (Judah et al., 2008).

Making people **aware of the benefits of and techniques for good hand hygiene** can improve hand hygiene but additional steps are needed to support good hand hygiene in staff and visitors.

- ✓ Education and awareness can improve compliance with good hand hygiene (Gould et al., 2017).
- ✘ attempts to improve hand hygiene through education and awareness alone can have limited and short-term impacts (Nakioba & Hayward, 2001).

## 2. Provide visual cues in restrooms to remind people to wash and dry hands

People's acts are often influenced by sub-conscious cues. The MINDSPACE guide notes that: "Priming is about how people's behaviour is altered if they are first exposed to certain sights, words or sensations. In other words, people behave differently if they have been 'primed' by certain cues beforehand". The Behaviour Change Wheel behaviour system also recognises the importance of prompt as it defines opportunity "all the factors that lie outside the individual that make the behaviour possible or prompt it."

People often intend to do something that they do not follow through on (Webb, 2006), so much so that the term 'intention-behaviour gap' has been coined to reflect this. Handwashing is a behaviour for which people show an intention-behaviour gap. For instance, a higher proportion of people show intent to wash their hands than do wash their hands (forthcoming), and people typically report that they wash their hands more frequently than they do.

While studies have shown that providing a cue can increase handwashing, it is less clear how the posters should be word or what images should be included. Despite the evidence that providing a cue increases handwashing many public restrooms do not provide posters or signage. For instance, a forthcoming study (Vaganay Miller &

Lawson, forthcoming) examined public restroom facilities between January-May 2019 in 8 different public locations (two shopping centres, food businesses, cinemas and service stations) in and around the greater Dublin and greater Belfast areas and found that "Only one of the public toilet locations surveyed had small handwashing signs above the sinks in the public restrooms. Other locations didn't have any handwashing posters, signage or any other type of health promotion material available in the public restrooms."

### ***Provision of cues***

Five studies tested the effect of providing a visual cue (three used posters/signs, one used an electronic dot matrix machine and one used an automated towel dispenser) in restrooms and all found an increase in handwashing.

**Posters/signs:** One study (Lapinski, Maloney, Braz, & Shulman, 2013) tested the effects of a poster in male public restrooms in a college, it found a higher share of males washed their hands when a poster was present (81-88% versus 70%) and a lower share did not wash their hands (12-19% versus 30%). In the study handwashing without a poster was compared to handwashing with two types of posters; one poster stated "One out of five college students wash their hands EVERY time they use the bathroom" and the other stated "Four out of five college students wash their hands EVERY time they use the bathroom", both posters contained an accompanying image.

A second study (Botta, Dunker, Fenson-Hood, Maltarich & Louise McDonald, 2008) tested the effect in university dorms, it found that posters were associated with increased handwashing as measured before and after the campaign (higher handwashing by males by 8 percentage points to 53%, and by 26 percentage points by females to 76%) and after the campaign (better performance by the experimental than the control group: 75% versus 63% washing hands, 67% versus 47% washing for more than five seconds, and 72% versus 62% using of soap). Posters containing "threat" messages<sup>1</sup> were placed in

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<sup>1</sup> Such as: "That's pee you know, wash your hands"; "Who else sat on this pot? Wash your hands"; "You just peed, wash your hands"; and "Poo on you, wash your bands". The authors report that "all messages included attention-grabbing graphics and photographs."

stalls and above urinals and a smaller “efficacy” sign (“wash for 20 seconds, use soap, and it's easy, just do it”) was placed on bathroom mirrors. Another study (Blackwell, Goya-Tocchetto & Sturman, 2018) examined hand-washing behaviour in public restrooms on the campus of university, and hypothesised that placing smiley face signs on the mirrors above the bathroom sinks would produce a pleasing feeling when entrants used the sinks and so increase handwashing. They report that the impact of the smiley face signs was positive but not statistically significant. A study (Lawson & Vaganay-Miller, 2019) tested the effect of a poster in male and female public restrooms in a university campus. There was no difference pre or post intervention in the percentage who practiced basic hand hygiene compliance (washed hands with water, soap and dried afterwards) 51.09% versus 55.39%, nor who practiced adequate hand hygiene compliance (washed hands with water and soap for 20 seconds or more and dried afterwards for 20 seconds or more), 7.88% versus 7.97%. The only effect was for females, who practiced more basic hand hygiene in the post-intervention observation period (62.81%) than during the pre-intervention period (49.23%) and this was statistically significant ( $p = < 0.01$ ). The poster consisted of an image of a dirty handprint showing various microbial growth on a hand, a heading under the image of “GERMS SPREAD EASILY! WASH YOUR HANDS!” and a narrative section of text so that the mean time it would take to read the poster would be at least the minimum recommended time that should be spent washing hands (20 seconds). During the study (pre- and post-intervention observation) signage was also erected on the exterior door of each restroom stating that “the sink and hand dryer areas are under observation for research purposes”.

**A flashing electronic dot matrix screen:** One study (Judah, 2009) consisted of 18 types of exposure - 7 experimental domains (each with 2 messages) and 2 different control conditions - which took the form of text-only messages displayed on an electronic dot matrix screen over the entryway to two restrooms at a highway service station, in full view of people entering. The messages were in capital letters, and they flashed for the duration of their presentation to attract attention (except the blank control condition, when no message was displayed). The study found that “In general, we found that most of the interventions increased levels of handwashing compared with the blank control condition.”

Undertaking an analysis by “domain” they found that most of the 7 domains<sup>2</sup> showed an increase in soap-use ratio compared with the blank control. The exception was knowledge activation for men, and for women the exceptions were the domains of comfort, cue and disgust.

**Presentation of a towel by an automatic towel dispenser upon approach:** providing a visual cue in public toilets by changing the sensor in a motion-activated hand towel dispenser to automatically present a towel when a person arrives at the hand-washing station rather than requiring the person to activate the towel dispenser in a rest room in a university increased soap use by 13.3% and towel use by 22.6% (Ford, 2014).

**Directional floor arrows:** One study (Blackwell, Goya-Tocchetto & Sturman, 2018) in public restrooms on the campus of a university tested the effect of placing lines of large, red, arrow-shaped stickers directed towards the sinks from the urinals and stalls with the intent to produce the notion that people should follow the arrows and use the sinks. They found that the arrows treatment was associated with a significant increase in handwashing (by up to 15%).

**Audio-visual reminder:** One study (Møller-Sørensen, Korshin, Mogensen & Høiby, 2016) tested whether an audio-visual reminder would remind restroom users to clean their hands. The compliance rate increased from 46% in the observation period to 76% in the intervention period (OR: 1.66; 95% CI: 1.54–1.79;  $p < 0.001$ ). The baseline compliance rates increased from 66% to 91% for HCWs (OR: 1.38; 95% CI: 1.23–1.55;  $p < 0.001$ ) and from 28% to 70% for patients/visitors (OR: 2.46; 95% CI: 2.19–2.76;  $p <$

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<sup>2</sup> The 7 domains were: Knowledge of risk: Inform people about a fact they may not know, which holds a danger for them (e.g., water alone will not kill germs, you need soap).; Knowledge activation: Remind people of what they know already or convince them of the importance of what they know. Unusual presentation can serve to activate this existing knowledge by increasing processing of the message.; Norms or affiliation: Raise concern for social judgments on people’s hygiene behaviours because of the knowledge that others might be concerned with standards for acceptable behaviour. Status or identity: Help people to feel that hand washing—or more broadly, cleanliness and being hygienic—is an important aspect of their self-image.; Comfort: Emphasize positive sensory qualities of having clean hands.; Disgust: Trigger the arousal of a “yuck” response; Cue: Provide people with a behavioural rule triggered by an object in the environment or an event (e.g., I’m coming out of a restroom) that encourages them to use soap after using the toilet.

0.001). The intervention consisted of installation of a new dispenser system at each location. An intelligent soap dispenser was installed in every location and an intelligent alcohol rub dispenser was installed in each HCW-restricted location. The system was programmed to sense flushing and elicit an audio-visual signal that would last until soap dispensing was performed. If dispensing were not performed the high-pitched sound would continue for 60 seconds. In locations where an alcohol-rub dispensing system was also installed (HCW-restricted areas) a blue pulsed light signal would make the restroom user aware of alcohol dispensing by turning on 10 seconds after soap dispensing had been performed, allowing the user time to dry-wipe the user's hands before performing hand-alcohol sanitation.

### ***Content of reminders***

**Social norms/affiliation:** The "S" in the MINDSPACE guide stands for social norms, reflecting the finding from behavioural studies that people "are strongly influenced by what others do". A review of factors associated with handwashing (Curtis, Danquah, and Aunger 2009) concluded that affiliation/social norms was a good candidate as a motivator to washing hands with soap and water (it was a review of 13 studies carried out in developing countries).

One study (Lapinski, Maloney, Braz, & Shulman, 2013) tested the effects of a social norm in a poster in male public restrooms in a college by comparing the effect on handwashing of a low prevalence message ("One out of five college students wash their hands EVERY time they use the bathroom" and an accompanying image) versus a high prevalence message ("Four out of five college students wash their hands EVERY time they use the bathroom" and an accompanying image). The study found that including a poster increased handwashing but they did not find a difference in handwashing between people exposed to the low versus high prevalence message. The authors of the study do not mention this, but perhaps it is difficult to interpret the finding of no difference between the low and high prevalence messages as while the high prevalence message may have stimulated handwashing by creating a social norm of handwashing, the low prevalence poster might have unintentionally stimulated disgust which could have increased handwashing.

As noted above one study (Judah, 2009) compared the effect of text messages on an electronic dot matrix screen on handwashing in restrooms at highway service stations using two messages for each of seven psychological domains. It compared the domains and the message within each domain to a blank message, and it also compared the domains to each other (while it shows the effect of each message compared to the blank control, it did not directly test the effect of different messages against each other).

Compared to a blank control message they found the "norms/affiliation" domain was the domain that had the second largest effect for men (9.6%,  $p=.003$ ) and the fourth largest effect for women (7.3%,  $p=.008$ ). When they compared the different domains with each other, rather than with the control condition, they found no statistically significant differences between domains.

The two messages for the "norm/affiliation" message were: "Is the person next to you washing with soap?" and "Shake hands confidently - Wash with soap". The "Shake hands confidently - Wash with soap" message did not have an effect over and above the blank control for men or women. The message "Is the person next to you washing with soap?" was noted by the authors as the message that "performed well in both genders", the best performer for men (a 12.1% relative increase in hand-washing ratio compared with the control condition) and the second best performer for women (10.9% increase).

Examining the paper also shows two other messages that had an effect for both men and women; a disgust-based message (described below) and a status/identity message, "Don't be a dirty soap dodger", which compared to a blank message increased the hand-washing ratio for men by 10.3% ( $p = .013$ ) and for women by 7.7% ( $p = .014$ ).

**Disgust:** The importance of emotions in influencing behaviours is reflected by the "A" for "affect" in the MINDSPACE guide which notes "our emotional associations can powerfully shape our actions".

A number of studies have suggested that disgust is relevant to handwashing. Disgust is ranked as the second-best motivator by caregivers (Nizame et al., 2013), it is significantly

associated with handwashing in studies conducted in both Haiti and Ethiopia (Contzen and Mosler, 2015), it is a moderator of the effect of the CHoB17 intervention to increase handwashing (George, 2017) and it is recommended as a good candidate as a motivator for washing with soap and water (Curtis, Danquah, and Aunger 2009).

One study (Porzig-Drummond, 2009) directly compared the effect of a disgust-based poster over and above an education alone poster in rest rooms near a university library on the hand hygiene practice of university students. It found that a poster designed to stimulate disgust was significantly more efficient at increasing hand hygiene behaviour (use of soap and paper hand towels) than an education alone poster. It also found an interaction between gender and treatment, with a greater difference between male and female participant scores in the education intervention (mean scores respectively, 0.25, 0.31) than between males and females in the disgust intervention (mean scores respectively, 0.32, 0.31). In the education poster, materials were intended to convey hand-hygiene information, while in the disgust condition the aim was to simultaneously instil hand-hygiene knowledge and to induce the emotion of disgust. Both posters communicated the same message about the spread of gastrointestinal illnesses (a subject that is generally disgust eliciting) and its prevention through hand hygiene. But the education poster employed informative language to describe the transmission process and showed an image of a clean hand, while the disgust poster used emotive language and pictured a long bread roll containing faeces as a filling, capturing the chain of disease transmission in the image.

As described under social norms/affiliation, the effect of text messages on an electronic dot matrix screen on handwashing in restrooms at highway service stations using two messages for each of seven psychological domains was examined in one study (Judah, 2009). Compared to a blank control message they found the "disgust" domain had the largest effect for men compared to a blank message, 9.8% ( $p = .001$ ), but the disgust domain did not have an effect for women 5.0% ( $p = .078$ ). Like other domains, when they compared the different domains with each other, rather than with the control condition, they found no statistically significant differences between the domains.



The two messages for the “disgust” domain were: "Don't take the loo with you - wash with soap" and "Soap it off or eat it later". The "Soap it off or eat it later" message, was effective for men (9.3%,  $p = .012$ ) but not for women (1.9%,  $p = .565$ ). While the "Don't take the loo with you - wash with soap" message was effective for both men (10.3%,  $p = .005$ ) and for women (8.3%,  $p = .013$ ).

**Observer effect:** A study in a women's public restroom (Pfattheicher, Strauch, Diefenbacher & Schnuerch, 2018) compared two posters. The posters contained the text “Hands spread pathogens. Hand washing protects” (in German) and an image at the top; three stars in control poster and “watching eyes” in the test poster. It found a significantly higher percentage of hand hygiene compliance in the watching eyes condition (83.3%) compared to the control condition (71.9%; odds ratio: 1.95,  $p = .01$ ).

Overall, it is not clear from the studies how exactly reminders should be worded. A recent online experiment of handwashing posters, which examines recall rather than actual behaviour, suggests that “bright infographics and minimal text make handwashing posters most effective”.<sup>3</sup>

<https://www.bi.team/blogs/bright-infographics-and-minimal-text-make-handwashing-posters-most-effective/>

Two studies examined interventions to increase handwashing with soap and water outside of restrooms. One study (Her & Behnke, 2019) tested the effect of a water flow timer and an informational poster at a student operated, full-service à la carte restaurant in a university. It found the intervention did not increase the frequency of handwashing but it did increase the duration of handwashing and the compliance rate to proper scrubbing duration.

Another study (Schroeder et al., 2016) examined handwashing behaviour with existing company signs (the poster was considered to be text-heavy and to focus specifically on occupational hazard safety, taken as the baseline) compared to handwashing behaviour with newly-developed handwashing pictograms. Compliance was compared in the short-

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<sup>3</sup> <https://www.bi.team/blogs/bright-infographics-and-minimal-text-make-handwashing-posters-most-effective/>

term (the next day) and the long term (two weeks after) in a poultry slaughter plant (facility A) and in a poultry further processing plant (facility B). Both facilities showed a significant increase ( $p < 0.05$ ) in soap use after the new sign was introduced at both short and long term time periods. There was a significant increase ( $p < 0.05$ ) in washing, time of washing, and rinsing observed by facility B employees, when baseline data was compared to the short term. Sign colour also had a significant effect ( $p < 0.05$ ) on employee behaviour for washing and time of washing. Behaviour for four of the five variables (soap, wash, time of wash, and towel use) was significantly different ( $p < 0.05$ ) between baseline and either experimental observation period. For all five handwashing variables collected there was an initial increase but also a subsequent reduction, up from 22.0% to 54.1% but then down to 26.2%.

### **Key Messages - Cues in Restrooms**

Providing a **visual cue/reminder** in public restrooms can increase handwashing.

- ✓ Using posters/signs for hand hygiene in restrooms have been associated with a higher share of users washing their hands (Lapinski et al., 2013; Botta et al., 2008), and increased use of soap (Botta et al., 2008).
- ✓ Flashing certain messages on an electronic dot matrix screen at the entrance to a restroom has been associated with increased handwashing (Judah, 2009).
- ✓ The automatic presentation of a paper towel upon approach to a towel dispenser has been associated with increased use of soap and increased use of towels (Ford, 2014).
- ✓ The use of large red arrow-shaped floor stickers directing towards the sinks from the urinals and stalls increased handwashing (Blackwell et al., 2018)
- ✓ The use of an audio-visual reminder, an intelligent alcohol rub dispensers which senses flushing and elicits an audio-visual signal that lasts until soap dispensing, increased handwashing (Møller-Sørensen et al., 2016).

Visual cues **should be clear, simple and visual.**

### 3. Make hand sanitisers available and dispensers easy to see and access

Opportunity is the third component of the behaviour system that underpins the Behaviour Change Wheel (Michie, 2011) and it is defined as “all the factors that lie outside the individual that make the behaviour possible or prompt it.” Clearly in some locations people do not have the opportunity to wash their hands (as it may not be practical to provide water, soap, and drying materials) and it is necessary to provide alcohol-based hand sanitiser (AHS) dispensers so that people can achieve good hand hygiene.

In addition, two general findings from behavioural science are that people are more likely to behave in a certain way when it is easy to do so and when their attention is drawn to the behaviour. Making things “Easy” is one of the guiding principles of the EAST Framework which notes that “small, seemingly irrelevant details that make a task more challenging or effortful (what we call ‘friction costs’) can make the difference between doing something and putting it off”. People’s behaviour is also greatly influenced by what our attention is drawn to it (Kahneman & Thaler, 2006), which is the basis for the principle of salience. Salience is the “S” in the MINDSPACE guide which notes that “People are more likely to register stimuli that are novel, accessible and simple.”

There is real world evidence from studies conducted in office workplaces but mainly in healthcare settings that using the principles of availability, easy to use and salience increases compliance with good hand hygiene. This includes usage by staff and by visitors.

#### ***Availability***

A systematic review of hand hygiene in office workplaces concluded that merely providing easier access to HH products can lead to improvement in HH compliance (Zivich, Gancz, & Aiello, 2018). This was more evident from a randomised cluster trial (Arbogast et al., 2016) where two groups of workers received educational interventions while the intervention groups also received HH products (alcohol

sanitiser dispensers, personal sanitiser dispensers, sanitizing wipes). The intervention group subsequently had significantly reduced hand hygiene preventable health care claims, during the first 12 months of the intervention period versus the prior 12 months the intervention group had a statistically significant 24.3% lower incidence of hand hygiene preventable health care claims compared with the control.

There is a certain point at which increasing availability does not increase use. This is discussed in the next section, and is demonstrated by a study (Keller et al., 2018) which examined the effect on HH compliance of a wearable dispenser by healthcare providers in an emergency department. Compliance was 56% (95% CI, 51-62%) during baseline and 64% (CI, 59-68%) during intervention period but the multivariable analysis (which adjusted for sex, profession, and WHO HH moment) there was no difference in HH compliance between baseline and intervention (adjusted Odds ratio: 1.22 (0.89–1.66),  $p = 0.22$ ). The authors reported that HCP perceived wearable dispensers as unnecessary since mounted dispensers were readily accessible.

### ***Location of dispensers***

A Cochrane systematic review (Gould, Moralejo, Drey, Chudleigh, & Taljaard, 2017) of hand hygiene in patient care concluded there is evidence that placement of alcohol-based hand-rub close to point of use probably improves hand hygiene compliance. This was based on a study (a RCT with cross-over) which found that placing AHR dispensers not only on walls but also on carts improved compliance (Munoz-Price et al., 2014), an increase of 0.3 hand hygiene events per hour, 0.54 in the control versus 0.84 in the intervention. Other studies in healthcare settings also support this conclusion. A study (Cure & Van Enk, 2015) found that higher HH compliance rates by hospital staff was associated with higher overall usability scores for sanitiser dispenser locations. The two individual characteristics of dispensers associated with increased compliance were accessibility (within arm's reach or less than one step from the entrance of a room) and visibility (easily visible on entry to a room). While another study in a hospital ICU (Thomas, Berg-Copas, Vasquez, Jackson, & Wetta-Hall, 2009) found that conspicuous and proximate positioning of AHS dispensers (at a height over beds, and increasing the

number from 8 to 16) resulted in increases in product usage, average daily product usage was 56% higher (188.8g in the control compared to 294.1g in the intervention).

Location of sanitisers also makes a difference to usage by visitors. Visitors to hospitals were more likely to use AHS when the dispenser were placed in free standing dispensers in the direct routes that people walk. In one study (Hobbs, Robinson, Neyens, & Steed, 2016) visitors were 5.28 times more likely to use AHS when it was in the middle of the lobby inside the main doors (rather than at the information desk which they did not have to walk directly past unless going to that desk). A study in another hospital (Birnbach et al., 2012) where all visitors had to register at a security desk, found that rather than having the dispenser on the wall to the right of the security desk that by placing the dispenser in front of the security desk, so that after each visitor who registered had to pass directly in front of the dispenser to leave the registration area, increased compliance (compliance rates of 9.33% versus 0.52%). The authors of both studies stress the benefits of free-standing dispensers, without barriers or other landmarks. Birnbach et al. (2012) also tested the effect of the new standalone dispenser in combination with a new sign attached to it, they found the combination of the dispenser plus the sign increased compliance over the baseline (compliance rates of 11.67% versus 0.52%) but there was no significant difference between the sign/dispenser combination and the dispenser alone (11.67% versus 9.33%,  $p = .352$ ).

There is also some evidence that the location of sanitisers may be more important than the number of sanitisers available within a space. The study mentioned above (Thomas et al., 2009) which found that conspicuous and proximate positioning of AHS dispensers (at a height over beds) resulted in increases in product usage, also found that increasing the number of dispensers (from 8 to 36) rather than their location did not increase usage. This is consistent with a separate study (Chan, Homa, & Kirkland, 2013) which suggested that the location of dispensers may be more important than the number alone, it found that dispensers in a hospital's hallway were used more than room dispensers, and that within a room the dispensers most used were those near the entrance rather than those near the bed or outside the bathroom in the room. The authors of that study conclude that these patterns may suggest a focus on HH before and after patient contact and not during patient care.

## **Reminders**

A Cochrane systematic review (Gould, Moralejo, Drey, Chudleigh, & Taljaard, 2017) of hand hygiene in patient care concluded there is evidence that cues such as signs or scent may slightly improve hand hygiene compliance. This is based on three studies. One RCT reported an increase in hand hygiene for a patient consequences sign compared to a slight decrease for a personal consequences sign. Another RCT reported increases in hand hygiene compliance for a scent cue and for a sign of stern male eyes but a decrease for a sign with female eyes. While one NRCT reported an increase in hand hygiene compliance with the light cue on day 2 compared but not on day 3. These studies, and additional studies found for this report are included in the following sections.

One study (Kim & Lee, 2019) examined the differences in interventional effects on hand hygiene compliance (HHC) among families and visitors in entering through the glass sliding door of 6 paediatric wards at a children's hospital. In the first intervention, a visual stimulus emphasized the location of the hand sanitiser; a hand sanitiser image (two hands) was attached above the dispenser and a notice was attached between the access card reader and the dispenser (it read "Bring your love with clean hands only. Sanitize your hands before entering"). In the second intervention, an additional auditory stimulus transmitted a cue through a motion sensor speaker. It announced "Just a moment! Please use the hand sanitizer before entering the ward" for five seconds in a child's voice when body movements were detected. The motion-sensor speaker was attached above the hand sanitiser, along with a sign indicating that it was a motion-sensor speaker to keep people from mistaking it to be a CCTV. During the preliminary observation, the HHC rates of family and non-family visitors were 0.0% and 1.5%, respectively. The interventions had a significant increase in the overall HHC. After the visual stimulus, they were 0.6% and 5.4% (OR, 5.22; 95% CI, 1.76–20.90), and after the audio-visual stimulus, 1.8% and 8.2% (OR, 8.67; 95% CI, 3.08–33.70).

Another study (Geilleit et al., 2018) assessed the effectiveness of a real-time infrared guided sensor system to automatically notify clinicians to perform HH just before first patient contact in paediatric outpatient clinics. The visual, proactive notification was a diffused 10 mm red light-emitting diode, and the auditory notification was a beeping

sound to notify clinicians to perform just-in-time HH if no HH was performed at the initial opportunity. Average baseline (without notifications) HH performance before first patient contact was 53.8%. With real-time auditory notifications that continued till HH was performed, overall HH performance increased to 100% ( $p < 0.001$ ), and with auditory notifications of a maximum duration of 15 seconds, HH performance was 80.4% ( $p < 0.001$ ).

One study (Pong, Holliday, Fernie 2019) used reminders from smart badges worn by staff to examine compliance with ABHR. The badges to produce real-time prompts to wash only when opportunities have been missed. The prompts were vibrations felt only by the badge wearer and are not audible to others, lasting 20 seconds, and green light-emitting diodes on the badge light up after washing at instrumented dispensers, remaining on while the wearer is considered to be clean. A missed opportunity is defined as a patient room entry or exit without handwashing occurring within 60 seconds beforehand. The electronic monitoring system was deployed 3 times (4 consecutive weeks) at 6-month intervals on a musculoskeletal rehabilitation nursing unit. There was a significant increase in aggregate dispenser use with every deployment and a decrease over several weeks following each withdrawal. Participation was high at the beginning of each deployment and declined during each deployment but was restored to a high level with the start of the next deployment.

A study (VanderWeg et al., 2019) in acute care hospitals examined the effect of the frequency of changing signs. Hand hygiene rates among health care workers were documented at entry and exit to patient rooms during the baseline period of normal signage (no change to signs) and throughout the intervention period; of signs changed weekly or changed monthly. They found that the frequency of changing reminder signs had no effect on HH rates overall. Units assigned to change signs most frequently demonstrated worsening adherence.

## ***Reminders, content of signage near dispensers***

Care is needed when selecting the wording to include in posters or signage near dispensers. One variation of cues had a negative effect by reducing compliance and some variations have not had any effect.

**Observer effect:** the observer effect or the “Hawthorne Effect” is where people change their behaviour when they think there are being watched. It has been shown to be relevant to handwashing. Several studies have found that people are more likely to wash their hands when someone else is present (e.g. Lapinski, Maloney, Braz, & Shulman, 2013).<sup>4</sup>

Some studies have tried to harness the observer effect by including images of eyes near dispensers in healthcare settings, but with mixed results. Two studies found an effect, using images of an older stern male, and three did not find an effect, albeit compliance was already high and possibly due to direct observation in two of these.

One study (King et al., 2016) found that while including an image of older stern male eyes above the dispenser (there was already a poster to the right of the dispenser) at the entrance to a SICU in a hospital (accessed by staff and service users) increased hand hygiene compliance (+6.7 percent points from a baseline of 15%) but placing an image of younger female eyes reduced compliance slightly (-5 percent points from a baseline of 15%). Another study (Beyfus et al., 2016) used the image of the eyes of an institutional leader (an older male) in attempt to engender a rapid response. The pictures of eyes were placed on two of four dispensers and the visual stimulus was rotated with each study time period across the dispensers. The average volume dispensed in stations with eyes was 279 cc versus 246 cc in the stations without eyes, a statistically significant difference ( $p = .009$ ).

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<sup>4</sup> Perhaps less widely reported is that the presence of others may also affect the amount of time men spend washing their hands. One study (Henningsen et al., 2011) found that men spent less time washing their hands when one other person was present versus when they were alone or when multiple people were present in the restroom, and the authors concluded that when alone, men feel that they can linger in the restroom unobserved, and when multiple people are present, they can blend in without being closely observed.



Stella et al. (2019) placed young male eyes near the top of a placard which included the message “Clean Hands Here” but it had no effect compared to a similar control placard with an image of mountains (staff were already participating in an electronic monitoring and feedback programme, and compliance in HH was 70%). Bolton et al. (2015) included a cue of being watched in a 'cleanse your hands' poster but did not find an effect (compliance in baseline without a poster was already 85%). Gaube, Tsivrikos, Dollinger and Lermer (2018) found that presenting a feminine eye-like stimuli in a screen above a dispenser did not improve hand hygiene behaviour in the patient rooms.

**Consequences:** The “I” in the MINDSPACE guide stands for incentives, it notes that people’s “responses to incentives are shaped by predictable mental shortcuts, such as strongly avoiding losses”. One study (Grant & Hofmann, 2011) tested for the effect of wording in hand hygiene signs in a hospital, it found that a patient consequences message (“Hand hygiene prevents patients from catching disease.”) increased mean hand hygiene compliance (+8.25 percentage points from a pre-test of 80.69%) but a personal consequences message (“Hand hygiene prevents you from catching disease.”) did not change compliance (a non-significant change of -0.29 percentage points from a pre-test of 80%) compared to a control message (“Gel in, wash out”).

**Salience:** A study tested that the effect of increasing the salient of AHS dispensers by locking flashing lights into the top of plastic containers holding dispensers (Rashidi et al., 2016), found it increased compliance (by 8.9 percentage points from 11.8% to 20.7%). The same study did not find an increase in usage when a pre-emptive sign (“STOP AHEAD Remove your gloves and wash your hands”) was also placed before dispensers (separated in time and distance) at the main entrance to a hospital in addition to the flashing lights (compliance was 20.5% with the sign and the flashing lights compared to 20.7% with only the flashing lights).

**Reminders and feedback:** One study (Gaube, Tsivrikos, Dollinger, Lermer, 2018) examined the effect of inducing injunctive social norms via an emoticon-based feedback system on hand hygiene behaviour. Electronic monitoring and feedback

devices were installed in patient rooms in a hospital (on top of hand-rub dispensers, next to the doorway) for a period of 17 weeks. In the emoticon condition, screens at the devices activated whenever a person entered or exited the room. Before using the alcohol-based hand-rub dispenser, a frowny face was displayed, indicating that hand hygiene should be performed. If the dispenser was subsequently used, this picture changed to a smiley face to positively reinforce the correct behaviour. Hand hygiene behaviour in the emoticon rooms significantly outperformed the behaviour in three other tested conditions. The average HHE ratio at 12.5% in the emoticon condition was statistically higher than in the other three conditions (screen-neutral: 5.3%, picture-eyes: 5.5% and picture-neutral: 5.5%) at intervention timepoint 1. The screen-emoticon group at 9.0% at intervention timepoint 2 was still significantly higher than in the picture-neutral rooms at 4.9%, and slightly higher than in the screen-neutral at 5.6% and picture-eyes at 5.6%.

**Other nudges:** One study (Caris, Labuschagne, Dekker, Kramer, van Agtmael & Vandenbroucke-Grauls, 2018) investigate whether posters including behavioural nudges displayed at the entrance to two non-ICU wards could increase the use of alcohol-based hand rub. Poster 1 was designed to appeal to the bandwagon effect, “Half of all healthcare workers perform well in hand hygiene. Which category do you belong to?”, and Poster 2 to appeal to the loss aversion and relative risk biases, “40% increase in hand hygiene, 40% decrease in healthcare-associated infections”. Regression analyses adjusted for workload showed that nudges displayed next to dispensers increased their overall use on one ward (poster 1: relative risk: 1.6, 95% CI: 1.2-2.2; poster 2: 1.7, 95% CI: 1.2-2.5) and during doctors’ rounds on both wards (poster 1: ward A: 1.7, 95% CI: 1.1-2.6, and ward B: 2.2, 95% CI: 1.3-3.8).

Another study, referred to under the observer effects, (King et al., 2016) found that adding a clean, citrus smell at a dispenser (there was already a poster to the right of the dispenser) at the entrance to a SICU in a hospital (accessed by staff and service users) increased hand hygiene compliance from 15.0% to 46.9% ( $p < .001$ ).

**Other tests:** One study (Birnbach, Rosen, Fitzpatrick, Everett-Thomas, Arheart, 2017) compared different signs out-side an intensive care unit (ICU), next to the

entry call button and a wall-mounted hand rub dispenser. It compared a baseline (that included minimal evidence-based constructs) with a sign disseminated by the Centers for Disease Control and Prevention and a sign designed by a team of patient safety experts. HH compliance was not significantly different among the signs (baseline 10% vs. CDC 18% vs. OIS 20%;  $p = 0.280$ ).

### ***Reminders, not at immediate point of use (nor in staff/public restrooms)***

A systematic review by Naikoba and Hayward (2001) includes four studies that examine the direct effect of reminders on HH by healthcare workers (HCWs). However, three of these are outside the scope of this review as they are not immediately scalable (e.g. Hughes et al., 1986 gave hospitalized children toy teddy bears, which carried slogans reminding HCWs to wash their hands) or require changes to other practices (e.g. Donowitz et al., 1986 examined if requiring HCWs to wear gowns would remind them of the need for handwashing, while McGuckin et al., 1999 examined the effect of asking patients to remind HCWs to wash their hands and of also placing a reminder labels on patient gowns). The fourth study covered in the systematic review, by Khatib et al. (2000), is within the scope of this review. It studied the use of reminders to improve handwashing among respiratory care nurses in an ICU. A “Wash Hands Use Gloves” message on labels were permanently placed on all ventilators. This intervention took place after a phase of the study that evaluated educational interventions. The frequency of handwashing before and after patient contact was significantly higher during this period (92% versus 46%), and the high rates were maintained over the four-week period of the study.

### **Key Messages - Sanitisers Availability, Accessibility and Visibility**

Making sanitisers **available**, when handwashing is not feasible, improves HH.

- ✓ Providing sanitisers to office workers, in addition to education, increases use. (Zivich et al., 2018; Arbogast et al., 2016)

Placing dispensers at **convenient locations** (easy to see and reach) increases use.

- ✓ Freestanding dispenser units in the direct routes that people naturally walk through hospital lobbies increases use by visitors to hospitals. (Hobbs et al., 2016; Birnbach et al., 2012).
- ✓ Easily visible and accessible sanitisers (e.g. easy to see and within easy reach) increases use by staff in hospitals. (Munoz-Price et al., 2014; Cure & Van Enk, 2015; Thomas et al., 2009).

Signage and audio-visual **reminders** can increase use of ABHS but it appears that minimal signage may be most effective once dispensers are immediately visible and at convenient locations.

- × Adding signage (before or at the top of) freestanding dispensers in the central entrance of hospitals did not increase use by visitors where dispensers were already easy to see and reach. (Rashidi et al., 2016; Birnbach et al., 2012)
- ✓ Small signs/images at wall mounted dispensers can increase usage in hospitals, but whether a positive effect is achieved depends on the wording/images used. (King et al., 2016; Grant & Hofmann, 2011)
- ✓ Audio-visual reminders can increase use of ABHS by visitors (Kim & Lee, 2019) and by healthcare staff. (Geilleit et al., 2018; Pong et al., 2019)

#### 4. Model good hand hygiene behaviours, help staff to form good HH habits and provide regular feedback

##### ***Modelling desired behaviours***

Within the MINDSPACE guide N stands for “norms” (which reflects the fact that people tend “do what those around us are already doing”) and M stands for “messenger” (as people are “heavily influenced by who communicates information”). The guide notes that social and cultural norms are the behavioural expectations, or rules, within a society or group. Norms can be explicitly stated or implicit in observed behaviour, and people often take their understanding of social norms from the behaviour of others. With regard to responses to messengers the guide notes that we are affected by the perceived authority of the messenger, are more likely to act on information if experts deliver it, but also if the messenger has demographic and behavioural similarities to ourselves, and if we have positive feelings towards the messenger. This suggests that managers, supervisors and influencers modelling or demonstrating good hand hygiene may support good hand hygiene behaviours.

A systematic review (Wilson, Jacob & Powell, 2011) concludes that “Role models can also influence hand-hygiene compliance.” The review discussed four studies, two of which had an element of empirical support. One study (Muto et al. 2000) found that higher compliance by physician was observed when role models perform hand hygiene and lower compliance when role models do not. Alcohol dispensers were mounted by every door on the two wards, and an educational campaign was conducted with four weekly visits to these floors to remind and reinstruct staff about the use of the alcohol dispensers and to address questions. Use of sanitiser (referred to as handwashing in the study) was observed including during a two-month follow-up. It was noted that "handwashing compliance by an attending physician was usually followed by compliance by all other physicians in a team on rounds. However, the converse was also true. When an attending physician failed to wash hands so did all other physicians on the team making rounds." Another study (Whitby et al., 2008) found mixed results when replicating a hospital wide hand

hygiene programme<sup>5</sup>, but suggested that strong leadership was the key to the program's success; improved compliance was achieved by staff in only one ward, where a senior medical leader provided ongoing, committed, and overt guidance in the hand-hygiene programme.

### ***Forming habits***

As noted earlier, the framework for understanding behaviour which underpins the Behaviour Change Wheel (Michie, 2011) is based on a "behaviour system" whereby motivation, capability, and opportunity interact to generate behaviour. It notes that motivation is "not just goals and conscious decision-making. It includes habitual processes, emotional responding, as well as analytical decision-making." Habits are actions that occur without conscious decision when encountering a cue.

A study (Whitby, McLaws & Ross, 2006) which examined the drivers of nurses' intention to perform handwashing argued that "the predominant driver of nurses' intentions to perform handwashing in healthcare settings was a translation of community handwashing behavior. For the most part, nurse participants described handwashing behavior as a habitual, unconscious practice rather than a thoughtful action associated with particular occasions." Another study (Curtis, Danquah & Aunger, 2009) described habits as learnt automated behaviours produced by cues, often as part of a routine and concluded that "it seems likely that handwashing, like toothbrushing, occurs as component part of daily routines and that these routines are often established from childhood" but that "more work is needed to understand exactly what these cues are for particular categories of handwashing behaviour."

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<sup>5</sup> The programme (Pittet et al., 2000) at the University of Geneva Hospitals was a 3-year hospital-wide program to promote hand hygiene with special emphasis on bedside hand disinfection, with the intent to reduce HAI. Senior management at the institution designated the program as a hospital-wide priority and provided funding. Wilson notes that the original authors (Pittet et al., 2000) attributed the success of the program to its multimodal and multidisciplinary approach.

None of the above studies, test the effect of forming habits. The notion of forming habits associated with handwashing has also been stressed in posters, for example the UK government's handwashing poster focuses on stimulating handwashing when people "Go into your home or your place of work, after you blow your nose, and before eating or handling food." Again, the author of this report did not find a study that formally tested the effects of this on actual handwashing behaviour.

### ***Performance feedback***

A Cochrane systematic review (Gould 2017) of hand hygiene in patient care concluded that performance feedback may improve hand hygiene compliance. This is based on a review of six studies where performance feedback was compared with some or no interventions for promoting hand hygiene, and all reported an increase in hand hygiene compliance. A RCT (Fisher et al., 2013) and a NRCT (Moghnieh et al., 2017) reported increases in hand hygiene compliance of 0-61 percentage points in intervention groups compared to no changes or a slight decrease of 4 percentage points in control groups. Two RCTs (Stewardson et al., 2016; Fuller et al., 2012) reported odds ratios of 1.61 to 2.09 favouring the intervention. While one ITS (Armellino et al., 2012) reported a weekly increase in hand hygiene compliance of 4% after an initial increase of 17.5%, and another ITS (Talbot et al., 2013) reported an increase of 37 percentage points during the active accountability phase of the study.

A separate systematic review (Wilson, Jacob & Powell, 2011) of interventions to improve handwashing concluded that "those, interventions employing social pressures [peer pressure, feedback or role models] have demonstrated varying influence on an individual's behaviour". With regard to performance feedback it noted that one study (Gould et al. 2007b) indicated feedback to healthcare workers can increase the levels of handwashing, another (Moongtui et al., 2000) found it was effective during the intervention period, but no retention was detected one month later, and one found not effect (Marra et al., 2008) at a private tertiary care hospital.

An earlier systematic review (Nakioba & Hayward, 2001) of studies to increase handwashing in healthcare workers concluded that “In all these studies it was shown that feedback may work because HCWs know they are being observed. It is difficult to blind healthcare workers to the fact that they are being observed if they are getting feedback on performance” but that the studies suggest that “personalized and non-personalized performance feedback can improve the frequency of handwashing, but if feedback is not continued the effect may not be sustained.” This is based on the findings from four studies allowed the effect of feedback to be studied separately, as follows:

- One study of 18 nurses in a 12 bed ICU (Dubbart, Dolce, Richter, Miller, & Chapman, 1986), found that performance feedback (posters of group performance in terms of handwashing errors on the previous day) for four weeks after an educational intervention found that the frequency of handwashing after patient contact did not change during the first week of feedback but it did by the second week (from 81% to 97% of episodes observed) and it stayed at high levels to the end of the four-week period.
- In a randomized controlled study (Mayer, Dubbert, Miller, Burkett, & Chapman, 1986) an experimental group was staff on a medical ICU ward, who received a moisturized handwashing soap and three weeks later performance feedback (daily memos to individual staff about the previous day’s handwashing) and the control group was staff on a surgical ICU ward who did not receive either of the interventions. Observed handwashing frequency after completed patient contacts in the experimental group increased immediately from a baseline of 63% and was sustained over a three-week period with frequencies of 85%, 91% and 98%. However, observed handwashing frequency of both groups carried out six months after the intervention had been discontinued, showed no difference between the control and experimental group.
- A study of a mixed group of 101 HCWs based on a seven-bed ICU and a six-bed high dependency unit (Van de Mortel & Heyman, 1995) examined the effect of (six weekly charts of non-personalized handwashing performance for five months). Results showed that there was a tendency for handwashing frequency to increase moderately during the intervention, however, this was only significant



for two staff groups, Namely, medical officers from 57% to 94% and physiotherapists from 20% to 77%, and these improvements were reported to have been sustained six months after the feedback.

- Another study (Tibbals, 1996) examined non-personalized performance feedback (brightly coloured posters showing weekly results of handwashing frequency for a group of 61 medical officers based on an ICU in a children's hospital). Handwashing frequency during the period of performance feedback was observed to increase substantially from 32% to 68% and from 33% to 64% before and after patient contact, respectively. Handwashing frequency seven weeks after performance feedback was lower than during the intervention period but still four times higher than baseline levels (54% vs. 12%).

### **Key Messages – Role Modelling, Performance Feedback and Habits**

The **modelling of good hand hygiene behaviours** by role models can increase hand-hygiene compliance. (Wilson, Jacob & Powell, 2011)

Providing **regular performance feedback** can improve hand hygiene (Gould 2017; Nakioba & Hayward, 2001).

Helping staff to form HH **habits** by linking handwashing and the use of ABHS with common events may increase hand hygiene.

## **5. Combine actions (e.g. 1 to 4) to maximise compliance with good hand hygiene**

Given that behaviours are often hard to change, but in particular to sustain change, a useful approach is often to combine more than one change strategy to address multiple barriers. Conclusions of systematic reviews of interventions to improve hand hygiene in healthcare settings support this approach.

In 2009 the World Health Organization (WHO) published guidelines for implementing and evaluating hand hygiene programmes in healthcare settings (WHO Guidelines 2009). The WHO guidelines also identify five components to be specifically implemented: ABHR at point of care or carried by the healthcare worker, training and education, observation and performance feedback, reminders (e.g. posters), and administrative support/institutional safety climate. The WHO guidelines have been widely disseminated internationally and multiple interventions have been implemented to try to improve hand hygiene compliance. A Cochrane systematic review (Gould 2017) of hand hygiene in patient care concluded there is evidence that multimodal interventions improve hand hygiene compliance. It concluded that it was unclear from existing studies (five studies; 184 centres) whether interventions that combine all strategies recommended in the WHO guidelines improve hand hygiene compliance but it concluded that hygiene compliance may be improved based on the evidence from studies that use multimodal interventions that include some but not all strategies recommended in the WHO guidelines (five studies; 56 centres), and by multimodal interventions that include all strategies recommended in the WHO guidelines plus additional strategies (six studies; 15 centres).

Another systematic review (Huis et al., 2012) examined studies to improve hand hygiene and used the Taxonomy of Behavioural Change Techniques to identify targeted determinants. Of the 41 studies reviewed they found that the most frequently addressed determinants were knowledge, awareness, action control, and facilitation of behaviour. Fewer studies addressed social influence, attitude, self-efficacy, and intention. They found that while the effectiveness of the strategies varied, most controlled studies showed positive results. The median effect size of these strategies increased from 17.6 (relative difference) addressing one determinant to 49.5 for the studies that addressed five determinants. They conclude that “Addressing combinations of different determinants showed better results.”<sup>6</sup>

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<sup>6</sup> Huis et al. (2012) note that “there seems to be a dose response effect.” They note that this is in contrast to Grimshaw et al.’s finding that there was no dose response relation between the number of improvement activities and the effects of multifaceted strategies. They note that Grimshaw reported that the lack of a rationale in the composition of a multifaceted strategy, such as mentioned by, may be a good explanation for the lack of a relationship between the number of improvement activities and the effect. In terms of the discrepancy between the two studies they note that the two studies used different framework to classify intervention the strategies for change, Grimshaw’s framework is based

An earlier systematic review (Nakioba & Hayward, 2001) of studies to increase handwashing in healthcare workers reviewed six studies that looked at the combined effect of the multiple interventions, and concluded that "results from these studies suggest that multifaceted approaches that combine education, continued feedback, reminders and policy changes can have an important effect on handwashing compliance."

### **Key Messages – Multiple interventions or determinants**

Systematic reviews conclude that **combining multiple interventions** can improve hand hygiene compliance (Gould 2017 et al., 2017; Nakioba & Hayward, 2001) and that **addressing combinations of different determinants** shows better results (Huis et al., 2012).

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on the form of performed improvement activities while their framework is based on the determinants of behaviour change. Using multiple activities is not necessarily the same as addressing multiple determinants or vice versa. For example, the distribution of educational materials and provision of educational sessions constitute two different improvement activities, but they would not label this strategy as multifaceted because both activities apply to the one determinant of 'knowledge'.

## References

- Arbogast, J. W., Moore-Schiltz, L., Jarvis, W. R., Harpster-Hagen, A., Hughes, J., & Parker, A. (2016). Impact of a comprehensive workplace hand hygiene program on employer health care insurance claims and costs, absenteeism, and employee perceptions and practices. *Journal of Occupational and Environmental Medicine*, 58(6), E231-E240. doi:10.1097/JOM.0000000000000738
- ArmellinoD, HussainE, SchillingME, SenicolaW, EichornA, DlugaczY, et al. Using high-technology to enforce low technology safety measures: The use of third-party remote video auditing and real-time feedback in healthcare. *Clinical Infectious Diseases* 2012;54(1):1-7.
- Baker DJ. Effects of a video based staff training with manager led exercises in residential support. *Ment Retard* 1998; 36: 198–204.
- Behavioural Insights Team. (2014). EAST: Four simple ways to apply behavioural insights. London: Behavioural Insights.
- Beyfus, T. A., Dawson, N. L., Danner, C. H., Rawal, B., Gruber, P. E., & Petrou, S. P. (2016). The use of passive visual stimuli to enhance compliance with handwashing in a perioperative setting. *American Journal of Infection Control*, 44(5), 496-499. doi:10.1016/j.ajic.2015.12.021
- Birnbach, D. J., Nevo, I., Barnes, S., Fitzpatrick, M., Rosen, L. F., Everett-Thomas, R., . . . Arheart, K. L. (2012). Do hospital visitors wash their hands? assessing the use of alcohol-based hand sanitizer in a hospital lobby. *American Journal of Infection Control*, 40(4), 340-343. doi:10.1016/j.ajic.2011.05.006
- Bolton, P. G. M., Rivas, K., Prachar, V., & Jones, M. P. (2015). The observer effect: Can being watched enhance compliance with hand hygiene behaviour? A randomised trial. *Asia Pacific Journal of Health Management*, 10(3), GS14-GS16.
- Bolton, P., & McCulloch, T. J. (2018). The evidence supporting WHO recommendations on the promotion of hand hygiene: A critique. *BMC Research Notes*, 11(1), 899-899. doi:10.1186/s13104-018-4012-3
- Botta, R. A., Dunker, K., Fenson-Hood, K., Maltarich, S., & McDonald, L. (2008). Using a relevant threat, EPPM and interpersonal communication to change hand-washing behaviours on campus. *Journal of Communication in Healthcare*, 1, 373–381. <https://doi.org/10.1179/cih.2008.1.4.373>
- Coignard B, Grandbastien B, Berrouane Y et al. Handwashing quality impact of a special program. *Inf Cont Hosp Epid* 1998; 19: 510–513.
- Cure, L., & Van Enk, R. (2015). Effect of hand sanitizer location on hand hygiene compliance. *American Journal of Infection Control*, 43(9), 917-921. doi:10.1016/j.ajic.2015.05.013
- Curtis VA, Danquah LO, Aunger RV. Planned, motivated and habitual hygiene behaviour: an eleven country review. *Health Educ Res*. 2009;24(4):655–673.

- Chan, B. P., Homa, K., & Kirkland, K. B. (2013). Effect of varying the number and location of alcohol-based hand rub dispensers on usage in a general inpatient medical unit. *Infection Control and Hospital Epidemiology*, 34(9), 987-989. doi:10.1086/671729
- Dean, M., Foddai, A., and Grant, I. (2017), *Hand sanitisers - their use and efficacy*. safefood. ISBN: 978-1-905767-62-5
- Dolan, Paul, Hallsworth, Michael, Halpern, David, King, Dominic and Vlaev, Ivo (2010) MINDSPACE: influencing behaviour for public policy. Institute of Government, London, UK.
- Dubbert PM, Dolce J, Richter W, Miller M, Chapman SW. Increasing ICU staff hand washing: effects of education and group feedback. *Inf Contr Hosp Epid* 1990; 11: 191–193.
- FisherDA, SeetohT, Oh May-LinH, ViswanathanS, TohY, YinWC, et al. Automated measures of hand hygiene compliance among healthcare workers using ultrasound: validation and a randomized controlled trial. *Infection Control & Hospital Epidemiology* 2013;34(9):919-28.
- Ford, E. W., Boyer, B. T., Menachemi, N., & Huerta, T. R. (2014). Increasing hand washing compliance with a simple visual cue. *American Journal of Public Health*, 104(10), 1851-1856. doi:10.2105/AJPH.2013.301477
- FullerC, MichieS, SavageJ, McAteerJ, BesserS, CharlettA, et al. The Feedback Intervention Trial (FIT)--improving hand-hygiene compliance in UK healthcare workers: a stepped wedge cluster randomised controlled trial. *PLoS ONE [Electronic Resource]* 2012;7(10):e41617.
- Gaube, S., Tsvirikos, D., Dollinger, D., & Lerner, E. (2018). How a smiley protects health: A pilot intervention to improve hand hygiene in hospitals by activating injunctive norms through emoticons. *Plos One*, 13(5), e0197465. doi:10.1371/journal.pone.0197465
- Geilleit, R., Hen, Z. Q., Chong, C. Y., Loh, A. P., Pang, N. L., Peterson, G. M., . . . de Korne, D. F. (2018). Feasibility of a real-time hand hygiene notification machine learning system in outpatient clinics. *Journal of Hospital Infection*, 100(2), 183-189. doi:10.1016/j.jhin.2018.04.004
- Gould D, Chamberlain A. The use of a ward based educational teaching package to enhance nurses compliance with infection control procedures. *J Clin Nurs* 1997; 6: 55–67.
- Gould, D. J., Moralejo, D., Drey, N., Chudleigh, J. H., & Taljaard, M. (2017). Interventions to improve hand hygiene compliance in patient care. *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.CD005186.pub4>
- Grant, A. M., & Hofmann, D. A. (2011). It's not all about me: Motivating hand hygiene among health care professionals by focusing on patients. *Psychological Science*, 22(12), 1494-1499. doi:10.1177/0956797611419172

- Hobbs, M. A., Robinson, S., Neyens, D. M., & Steed, C. (2016). Visitor characteristics and alcohol-based hand sanitizer dispenser locations at the hospital entrance: Effect on visitor use rates. *American Journal of Infection Control*, 44(3), 258-262. doi:10.1016/j.ajic.2015.10.041
- Judah, G., Aunger, R., Schmidt, W., Michie, S., Granger, S., & Curtis, V. (2009). Experimental pretesting of hand-washing interventions in a natural setting. *American Journal of Public Health*, 99, S405-S411. doi:10.2105/AJPH.2009.164160
- Kahneman, D., & Thaler, R. H. (2006). Anomalies - utility maximization and experienced utility. *Journal of Economic Perspectives*, 20(1), 221-234. doi:10.1257/089533006776526076
- Khatib M, Ghassan J, Abdallah A, Ibrahim Y. Hand washing and use of gloves while managing patients receiving mechanical ventilation in the ICU. *Chest* 1999; 116: 172–175.
- Kim, D., & Lee, O. (2019). Effects of audio-visual stimulation on hand hygiene compliance among family and non-family visitors of pediatric wards: A quasi-experimental pre-post intervention study. *Journal of Pediatric Nursing-Nursing Care of Children & Families*, 46, E92-E97. doi:10.1016/j.pedn.2019.03.017
- King, D., Vlaev, I., Everett-Thomas, R., Fitzpatrick, M., Darzi, A., & Birnbach, D. J. (2016). "Priming" hand hygiene compliance in clinical environments. *Health Psychology*, 35(1), 96-101. doi:10.1037/hea0000239
- Lapinski, M. K., Maloney, E. K., Braz, M., & Shulman, H. C. (2013). Testing the effects of social norms and behavioral privacy on hand washing: A field experiment. *Human Communication Research*, 39(1), 21-46. doi:10.1111/j.1468-2958.2012.01441.x
- Lawson, A., & Vaganay-Miller, M. (2019). The effectiveness of a poster intervention on hand hygiene practice and compliance when using public restrooms in a university setting. *International Journal of Environmental Research and Public Health*, 16(24), 5036. doi:10.3390/ijerph16245036
- Mayer JA, Dubbert PM, Miller M, Burkett PA, Chapman SW. Increasing hand washing in an ICU. *Infect Control* 1986; 7: 259–262.
- Maxine Burton, Emma Cobb, Peter Donachie, Gaby Judah, Val Curtis and Wolf-Peter Schmidt The Effect of Handwashing with Water or Soap on Bacterial Contamination of Hands *Int. J. Environ. Res. Public Health* 2011, 8, 97-104; doi:10.3390/ijerph8010097
- 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. doi:10.1186/1748-5908-6-42
- MoghniehR, SobohR, AbdallahD, El-HelouM, Al HassanS, AjourL, et al. Health care workers' compliance to the My 5 Moments for Hand Hygiene: Comparison of 2 interventional methods. *American Journal of Infection Control* 2017;45(1):89-91. [DOI: 10.1016/j.ajic.2016.08.012]

- Moller-Sorensen, H., Korshin, A., Mogensen, T., & Hoiby, N. (2016). New technology markedly improves hand-hygiene performance among healthcare workers after restroom visits. *Journal of Hospital Infection*, 92(4), 337-339. doi:10.1016/j.jhin.2015.09.012
- Munoz-Price, L. S., Patel, Z., Banks, S., Arheart, K., Eber, S., Lubarsky, D. A., & Birnbach, D. J. (2014). Randomized crossover study evaluating the effect of a hand sanitizer dispenser on the frequency of hand hygiene among anesthesiology. *Infection Control and Hospital Epidemiology*, 35(6), 717-720. doi:10.1086/676425
- Muto, C.A., Siström, M.G., and Farr, B.M., 2000. Hand hygiene rates unaffected by installation of dispensers of a rapidly acting hand antiseptic. *American Journal of Infection Control*, 28, 273–276.
- Naikoba, S., & Hayward, A. (2001). The effectiveness of interventions aimed at increasing handwashing in healthcare workers—A systematic review. *Journal of Hospital Infection*, 47, 173–180. <https://doi.org/10.1053/jhin.2000.0882>
- Pittet, D., et al., 2004. Hand hygiene among physicians: performance, beliefs, and perceptions. *Annals of Internal Medicine*, 141, 1–8.
- Pong, S., Holliday, P., & Fernie, G. (2019). Effect of intermittent deployment of an electronic monitoring system on hand hygiene behaviors in healthcare workers. *American Journal of Infection Control*, 47(4), 376-380. doi:10.1016/j.ajic.2018.08.029
- Porzig-Drummond, R., Stevenson, R., Case, T., & Oaten, M. (2009). Can the emotion of disgust be harnessed to promote hand hygiene? experimental and field-based tests. *Social Science & Medicine*, 68(6), 1006-1012. doi:10.1016/j.socscimed.2009.01.013
- Rashidi, B., Li, A., Patel, R., Harmsen, I. E., Sabri, E., Kyeremanteng, K., & D'Egidio, G. (2016). Effectiveness of an extended period of flashing lights and strategic signage to increase the salience of alcohol-gel dispensers for improving hand hygiene compliance. *American Journal of Infection Control*, 44(7), 782-785. doi:10.1016/j.ajic.2016.01.002
- Schroeder, M., Yang, L., Eifert, J., Boyer, R., Chase, M., & Nieto-Montenegro, S. (2016). Evaluation of how different signs affect poultry processing employees' hand washing practices. *Food Control*, 68, 1-6. doi:10.1016/j.foodcont.2016.03.019
- Stella, S. A., Stace, R. J., Knepper, B. C., Reese, S. M., Keniston, A., Burden, M., & Young, H. L. (2019). The effect of eye images and a social norms message on healthcare provider hand hygiene adherence. *Infection Control and Hospital Epidemiology*, 40(7), 748-754. doi:10.1017/ice.2019.103
- StewardsonAJ, SaxH, Gayet-AgeronA, TouveneauS, LongtinY, ZinggW, et al. Enhanced performance feedback and patient participation to improve hand hygiene compliance of healthcare workers in the setting of established multimodal promotion: a single-centre, cluster randomised controlled trial. *Lancet Infectious Diseases* 2016;16(12):1345-55.

- Talbot TR, Johnson JG, Fergus C, Domenico JH, SchaCner W, Daniels TL, et al. Sustained improvement in hand hygiene adherence: utilizing shared accountability and financial incentives. *Infection Control & Hospital Epidemiology* 2013;34(11):1129-36.
- Tibbals J. Teaching hospital medical staff to hand wash: *Med J Aus* 1996; 164: 395–398.
- Thomas, B. W., Berg-Copas, G. M., Vasquez, D. G., Jackson, B. L., & Wetta-Hall, R. (2009). Conspicuous vs customary location of hand hygiene agent dispensers on alcohol-based hand hygiene product usage in an intensive care unit. *Journal of the American Osteopathic Association*, 109(5), 263-267.
- Vaganay Miller, M. and Lawson, A., (forthcoming). An investigation of hand washing facilities and practices in various settings on the island of Ireland – interim report.
- Van de Mortel T, Heyman L. Performance feedback increases the incidence of hand washing by staff following patient contact in an ICU. *Aus Crit Care* 1995; 8: 8–13.
- Vander Weg, M. W., Perencevich, E. N., O'Shea, A. M. J., Jones, M. P., Sarrazin, M. S. V., Franciscus, C. L., . . . Reisinger, H. S. (2019). Effect of frequency of changing point-of-use reminder signs on health care worker hand hygiene adherence A cluster randomized clinical trial. *Jama Network Open*, 2(10), e1913823. doi:10.1001/jamanetworkopen.2019.13823
- Whitby M, McLaws M-L, Ross MW. Why healthcare workers don't wash their hands: a behavioral explanation. *Infect Control Hosp Epidemiol* 2006; 27: 484–92.
- Wilson, S., Jacob, C. J., & Powell, D. (2011). Behavior-change interventions to improve hand-hygiene practice: A review of alternatives to education. *Critical Public Health*, 21(1), 119–127.
- WHO public health research agenda for influenza: 2017 update. Geneva: World Health Organization; 2017. [https://www.who.int/influenza/preparedness/pandemic/PIRM\\_update\\_052017.pdf](https://www.who.int/influenza/preparedness/pandemic/PIRM_update_052017.pdf)
- WHO, World Water Day 2020 highlights the essential role of handwashing 20-03-2020  
<http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/world-water-day-2020-highlights-the-essential-role-of-handwashing>
- Zivich, P. N., Gancz, A. S., & Aiello, A. E. (2018). Effect of hand hygiene on infectious diseases in the office workplace: A systematic review. *American Journal of Infection Control*, 46(4), 448-455. doi:10.1016/j.ajic.2017.10.006



## APPENDIX A: METHOD

The methodology was tailored to the purpose of the paper and the timeframe available. The purpose was to quickly identify practical actions (including actions that could be scaled nationally) in workplaces and public facilities to help increase good hand hygiene practice, and to package these under a small number of approaches.

### Information search

Handwashing and the effectiveness of handwashing: the websites of the following organisations were searched: the Centers for Disease Control and Prevention (CDC), European Centre for Disease Prevention and Control (ECDC) and *saferfood*.

Interventions to increase handwashing: This involved three steps. First, the 21 papers in the hand hygiene section of the recently published working paper by Lunn et al. (2020) *Using Behavioural Science to Help Fight the Coronavirus*, were examined and studies that were intervention studies were included in the analysis. Second, the reference sections in the relevant intervention studies and the systematic reviews from Lunn et al. (2020) were hand searched to identify additional studies. Third, since the most recent systematic review in Lunn et al. was published in 2017 an additional search of Web of Science was conducted from January 2016 to 2020 using terms focused on categories 2 and 3 in this report, and the 1,500 results were examined for relevance. The key inclusion criteria for this additional step were (a) an intervention study to improve hand hygiene with a comparator of performance, (b) set in a workplace or public building and (c) an intervention in category 2 or 3 of this paper (given the ease of scaling these interventions) in an OECD country.

### Evidence synthesis

The information from intervention studies was extracted with regard to the type of behaviour that was targeted (handwashing with soap and water or the use of ABHS), the setting (within restrooms or elsewhere in buildings), the specific type of intervention, and the overall results of the study. In the Executive Summary an indication of the evidence to support actions is provided for summary purposes (\*\* = empirical evidence from 2+ studies, \* = empirical evidence from 1 study, \* = suggestive evidence only).

### Limitations

Key limitations include the fact that most of the studies were restricted to English-language publications, there may be a risk of publication bias in the individual studies reviewed, this paper does not distinguish findings by source of funding for studies, and although the intervention studies are from peer reviewed journals this paper does not explicitly quality appraise the studies covered. This paper was produced over a restricted time period, in the four weeks to 24<sup>th</sup> April 2020, so all the intervention studies were undertaken before the emergence of COVID-19.