

REVIEW ARTICLE

Nudges as a suitable and effective intervention to improve hand hygiene compliance among healthcare workers in patient care settings: a narrative review

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Abstract

Hand hygiene among healthcare workers (HCWs) is critical to preventing harm to patients in the process of healthcare delivery by minimising healthcare-associated infections (HCAI) in patient care settings. However, low compliance rates of hand hygiene plague healthcare, making it a global priority. Nudges are potentially a suitable and effective intervention to improve compliance among HCWs. In this review, nudges are defined as a method of intervention that attempts to influence people's judgement, choice or behaviour in a predictable way, without forbidding any options or significantly changing economic incentives. This review aims to determine whether nudges are a suitable and effective intervention for improving hand hygiene compliance among HCWs in patient care settings. This review finds nudges suitable for inculcating professional handwashing habits as they are a form of ritualistic and automatic behaviour driven by unconscious processes, which can be influenced by social influences and environmental cues. A literature search conducted up until January 2022 identified 19 primary studies – 10 of which belonged to a systematic review – investigating the isolated effect of nudge interventions on improving HCW hand hygiene compliance in patient care settings. There is some indication that performance feedback may be effective, but significant heterogeneity of interventions and study designs make it difficult to conclude any further. Future research should employ study designs with minimal bias, use automated hand hygiene auditing systems and should address structural and resource-related constraints before evaluating nudge interventions.

Keywords: *hand hygiene; handwashing; compliance; infection control; healthcare associated infection; Singapore*

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Healthcare-associated infections (HCAI) cause a significant healthcare burden in both high-income countries (HICs) and low-to-middle-income countries (LMICs), with an estimated prevalence of 7.6 and 10.1% of hospitalised patients, respectively (1). HCAs increase patient mortality, long-term disability, prolong hospital stays, increase financial costs to healthcare systems and increase financial and psychological burden to patients and families (1). In the European Union, for example, an estimated 2,609,911 new cases of HCAI occur every year, with the most significant pathogens causing 91,130 deaths per year (2). In Southeast Asia, the attributable mortality of HCAI ranged from 7 to 46% and an excess hospital stay of 5–21 days for infected patients (3).

Since the mid-1800s, work from Ignaz Semmelweis has shown that hand hygiene among healthcare workers (HCWs) prevents HCAs (4). Many studies since the 1960s have demonstrated this beneficial effect in general wards,

surgical units, nurseries, adult and neonatal intensive care units (4). Hand hygiene is simple, cost-effective and the most crucial factor in reducing HCAs (5–7). However, HCWs often fail to comply with hand hygiene practices, and low compliance rates are a universal problem (7, 8). The World Health Organization's (WHO) investment in improving worldwide hand hygiene practices among HCWs is an indicator of its global importance (9).

A HCW's inclination for hand hygiene may, to a minor extent, relate to concern for their own health and safety. However, unlike health behaviours in the general population, it is strongly driven by a professional obligation to achieve optimal patient safety (10). In lieu of the strong evidence for potential harm, non-compliance to hand hygiene recommendations represents a failure to uphold this professional responsibility – neglecting the biomedical principle of 'non-maleficence' (11). To minimise the negative impact of HCAs and maintain duty of care to patients,

it is paramount that effective interventions to improve HCW hand hygiene compliance are implemented.

What is a nudge?

This review defines nudges as an overarching method that attempts to influence people's judgement, choice or behaviour in a predictable way, without forbidding any options or significantly changing economic incentives (12, 13). First conceptualised by Thaler and Sunstein (13), it has its roots in behavioural science (14–16). The theory underlying nudges describes a balance in human behaviour between acting in a reflective and a non-reflective manner, involving automatic and involuntary actions. Nudge theory concerns itself with the latter and is of the view that everyday human behaviour is often unconscious and cued by stimuli in the environment (17, 18). Overuse of this system in aspects of decision-making causes people to act poorly even when consequences are undesired (17). This results in a gap between values and behaviour and is particularly the case for health-related behaviour (14, 17). Nudges attempt to address this gap by making simple alterations to the environment that act as catalysts for positive behaviour change (19). Nudge interventions are also designed to be non-coercive, steering people towards making better decisions, without restricting available choices and alternatives (13, 14, 20).

Nudging can include a wide variety of strategies, including simplification of processes, changing default options, altering physical layouts, subconscious environmental cues, reminders, providing performance or social norm feedback and pre-commitment strategies (13, 14). The method has gained considerable popularity globally in dealing with a wide range of problems arising from behaviour (14). In the field of HCW hand hygiene compliance, numerous studies have employed nudges. However, these are often grouped into packages of multimodal interventions, which make it difficult to tease out the individual effectiveness of the nudge intervention itself. There is no review that has taken a holistic approach towards the use of nudges from both a

theoretical and effectiveness standpoint in this area of patient safety. This review aims to determine whether nudges are a suitable and effective intervention for improving hand hygiene compliance among HCWs in patient care settings.

Methods

This narrative review will be split into three parts. Firstly, the review will examine the advantages and disadvantages of nudges in general, specific to achieving public health objectives and specific to HCW hand hygiene. Secondly, this review will assess the suitability of nudges as a method for increasing HCW hand hygiene compliance in patient care settings, by analysing factors that influence HCW hand hygiene practices. Relevant and up-to-date qualitative systematic reviews that summarise these factors will be identified.

The final part of this narrative review will identify evidence for the effectiveness of nudge interventions in improving HCW hand hygiene compliance in patient care settings. A PubMed search will be conducted using the terms 'hand hygiene'/handwashing' and 'compliance' and 'intervention'. Studies will be identified starting from the most up-to-date systematic review, up until the end of January 2022. The inclusion and exclusion criteria are shown in Table 1.

Why should we consider nudges?

As an overarching method, nudges are an attractive intervention as they can be applied to a wide array of problems arising from behaviour and are often easy to deliver and low cost (14, 20, 21). In general, they have a greater impact than traditional tools, such as financial incentives and education, and can be cost-effective for healthcare objectives, such as influenza vaccine uptake (21). The United Kingdom's MINDSPACE report in 2010 (22), found 'nudging' to have the potential to bring about significant changes at a relatively low cost, especially considering government fiscal constraints. Compared to legislation, public support for nudges is high, especially when they align with citizen interests,

Table 1. Inclusion and exclusion criteria

Inclusion criteria	
Population	Healthcare worker hand hygiene practices in patient care settings
Intervention	Isolated use of nudge interventions*
Outcome	Healthcare worker hand hygiene compliance rates
Study types	Quasi-experimental studies, non-randomised controlled trials, randomised controlled trials
Language	English
Exclusion criteria	
Intervention	Multimodal/combination of interventions, or interventions that did not fall within the definition of nudges*
Study types	Observational studies

*Nudges as defined by the review.

intentions are legitimate, and there is no lack of trust in government (20, 23–27).

On the flipside, nudge theory has received criticism for its misalignment with the core principles of health promotion. This is because they work best when people are unaware their behaviour is being influenced, fail to recognise the social context in which behaviour is embedded, leave people out of the deliberative process and result in ‘victim-blaming’ (18, 20, 28, 29). However, unlike patient-focused health behaviours, such criticism may not be relevant to HCW hand hygiene behaviours as it is largely rooted in the concept of patient safety and is less concerned with empowering individuals.

Are nudges a suitable intervention for improving healthcare workers’ hand hygiene?

Studies investigating the reasons for poor HCW hand hygiene compliance find that low compliance rates are not attributable to poor knowledge but to less than optimal practice (30, 31). Handwashing, as a practice, is a ritualistic behaviour driven by deep and unconscious processes belonging to the non-reflective system of cognitive processing, as it involves automaticity and mental efficiency (17, 32, 33). Therefore, inculcating professional handwashing habits among HCWs through subconscious cues should theoretically increase hand hygiene compliance, as conceptualised in nudge theory (10, 32).

To support this theory, this review identified two recent qualitative systematic reviews, which investigated factors influencing HCW hand hygiene compliance (31, 34). The reviews described HCW hand hygiene as an automatic behaviour, influenced by social influences and environmental cues, which could be improved by surveillance and

monitoring – suggesting that they could be amenable to nudges (31, 34). However, these were described as low-to-moderate confidence findings in the review by Chatfield et al. (31), whereas structural and resource-related factors were of greater importance. The other review lacked a clear appraisal of findings.

Are nudges an effective intervention for improving healthcare worker hand hygiene?

This review also conducted a literature search to identify evidence for the effectiveness of nudge interventions on HCW hand hygiene compliance in patient care settings. A Cochrane systematic review by Gould et al in 2017 (35) was identified as the most up-to-date review, including studies up till October 2016. Although the systematic review looked at all types of interventions, this review was able to isolate three categories of interventions that fit within this review’s definition for nudges, namely, performance feedback, environmental cues and altering physical layouts of alcohol-based hand rub (ABHR) terminals. Overall, it found performance feedback and the use of visual or olfactory environmental cues may be effective although there was low certainty of evidence. There was moderate certainty of evidence that altering the physical layouts of ABHR terminals would improve hand hygiene compliance; however, only one study supported this intervention.

A further two randomised controlled trials (RCTs) and seven quasi-experimental studies (36–44) were identified from October 2016 to January 2022 (see Table 2). Put together, the results were largely consistent with the Cochrane review findings. Two studies found performance feedback to be effective, while one study employing a mix

Table 2. Summary of studies identified from October 2016 to January 2022

Study	Type of nudge	Effect on hand hygiene compliance
Randomised controlled trials		
Pires 2021 (36)	Environmental cue (novel wearable device)	• Did not change compliance
Donati 2020 (37)	Performance feedback	• Increase in intervention compared to control arm
Quasi-experimental studies		
Stella 2019 (38)	Environmental cue (visual posters with social feedback components)	• No improvement in hand hygiene adherence
Keller 2018 (39)	Environmental cue (wearable dispensers)	• No increase in hand hygiene compliance
Scherer 2019 (40)	Performance and social feedback	• No increase in hand hygiene compliance during the feedback phase of both audit methods
Caris 2018 (41)	Environmental cue (visual posters)	• Increase in use of alcohol dispensers when shown next to visual cues
Diefenbacher 2019 (42)	Performance feedback and goal-setting	• Increase in hand hygiene events with performance feedback alone and when combined with goal-setting
Huang 2021 (43)	Environmental cue (auditory reminders)	• Improved hand hygiene compliance on room entry and exit
Ibrahim 2021 (44)	Environmental cue (auditory reminders)	• Improved hand hygiene compliance compared to baseline (although not statistically significant)

of performance and social feedback did not. Interventions employing environmental cues were heterogeneous, and only three of six studies found them to be effective. Both studies using auditory cues showed improved compliance; however, there were inconsistent results with visual cues. Critical appraisal of both RCTs using the Cochrane collaboration's tool for assessing risk of bias (45) identified a high risk of bias because of a lack of participant blinding and only collecting outcome data in the daytime. The seven quasi-experimental studies were subject to significant time-dependent bias, and the majority did not randomise interventions or mask participants and outcome assessors.

Limitations of the evidence base include the lack of assessment of long-term effects of nudge interventions, wherein only 6 of 19 primary studies identified by the Cochrane review and literature search followed up participants or participating sites for 12 or more months (37, 43, 46–49). The studies analysed also have poor generalisability to LMICs, as all but one primary study (44) was carried out in high or upper-middle income countries, with the majority in the United States. Lastly, because of the heterogeneity of evidence, there are no meta-analyses summarising the effect of nudge interventions on HCW hand hygiene compliance, making cost-effective assessments and implementation challenging.

Conclusion

HCW hand hygiene is considered the single most important factor in reducing HAIs and its associated burden; however compliance rates are often suboptimal (5–8). This review finds nudges have the potential to improve compliance by inculcating hand hygiene habits in HCWs. However, prevailing evidence on its effectiveness is largely ambiguous, because of the heterogeneity of interventions, inconsistency in study findings and use of less rigorous study designs.

Research on nudges is also inherently limited by the lack of a precise, operational definition (14, 18, 19). Critics have argued that many examples of nudges in Thaler and Sunstein's book (13) do not fit with their own definitions, and largely apply to specific contexts that have limited public health relevance (18, 19). As a result, evidence synthesis is challenging, which explains why there are few reviews summarising the effectiveness of nudges in public health (14, 18, 19). For the purposes of this narrative review, studies were included based on the author's interpretation of the interventions identified in the literature search, and whether they fit with the review's definition of nudges. This suggests an element of subjectivity is inherent to research on this topic, unless a more explicit definition of nudges can be developed.

This review finds some indication that performance feedback may be effective when used in isolation. However, meta-analyses, cost-effectiveness studies, and more high-quality evidence are needed before they can realistically replace current recommendations. Furthermore, the evidence remains unclear as to how long nudge interventions last, whether they are transferable between topics and domains, who they are effective for, their potential impact on inequalities, and other unintended consequences (22). More research is also needed to evaluate the effectiveness of nudges in low-resource healthcare settings, and strategies using wearable feedback devices, environmental cues, social feedback, and interventions altering ABHR terminal placements. A formal systematic review of the evidence on this topic could deepen our understanding of the current evidence base.

Future research should employ randomised controlled study designs, with rigorous randomisation processes, best effort allocation concealment, and blinding of participants and outcome assessors. Alternatively, with the advent of digital hand hygiene auditing systems, researchers can augment future studies with high volume hand hygiene event assessments that can be performed throughout the day, and are not subject to observer bias and inaccuracies (38). Additionally, future research should not neglect the importance of structural and resource-related constraints, which should be addressed before considering an evaluation of nudges on HCW hand hygiene compliance.

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