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Evaluation of the effect of hand hygiene reminder signs on the use of antimicrobial hand gel in a clinical skills center

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Summary Hand hygiene is a critical element of patient care, which needs to be learned and reinforced to become an autonomous behavior. Previous studies have explored aspects of hand hygiene behavior in the clinical workplace, but not in controlled learning environments with health professional students. Development of good hand hygiene behavior requires a multi-faceted approach, including education, reinforcement, feedback and audit. Our study aimed to identify the effect of unannounced hand hygiene reminder signs on the use of antimicrobial hand gel in a clinical skills center. Year 2 MBChB students received practical learning regarding hand hygiene in their clinical skills sessions. Baseline hand gel use was measured using before and after weighing of the bottles. An A5 sign was created to remind the students to hand cleanse and was used as an unannounced intervention. In semester 2 (2012), the student groups were randomly allocated as intervention (signs) or control (no signs). Hand gel use at all sessions was measured. Data were compared between groups and over time. In total, 237 students attended the skills sessions twice during the study. Hand gel use was not significantly different between the two study arms. Overall use was low, typically 1—2 hand gel pumps per student per session. In addition, hand gel use fell over time. A visual reminder to cleanse hands did not appear to have any effect on behavior. These findings may have implications for their value in a clinical setting. Low overall use of hand gel may be context-dependent. Students are in a simulated environment and examine 'healthy'

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peers or actors. There may have been inconsistent tutor role-modeling or problems with the educational approach to the skill. Analysis at the level of the group, and not the individual, may have also limited our study.

Introduction

Background

Hand hygiene is a cornerstone of good practice for infection control in clinical environments. International guidelines advise hand-washing with soap and water at the start of a clinical shift, after visible organic soiling and at intervals across the working day in association with the use of antimicrobial hand gel for all other clinical contacts [1,2]. Antimicrobial hand gel has been shown to be effective and is advocated after the initial soap and water wash in routine care [3]. All guidelines advocate the World Health Organization's 'Five moments of hand hygiene' [2]. In New Zealand, 'Hand Hygiene New Zealand' (HHNZ) was established to lead in the promotion, advocacy and audit of good practice [4]. HHNZ uses a multi-faceted approach, as recommended by the World Health Organization [5], and publishes performance reports.

Studies in the clinical workplace

Observational studies in the clinical workplace universally reveal suboptimal hand hygiene practice and compliance for health professionals; in their 2009 report, the WHO quotes the mean adherence across seventy-four studies as 39.7% [2]. The typical baseline compliance rate for New Zealand in 2009 was 35% [6]. Researchers have explored a range of methods for improving compliance. Intervention studies have commonly taken the form of educational packages combined with environmental changes [6—12]. Typically, impact has been measured through global hand gel use in a clinical environment [8], by observed gel use [9,10], or through observed compliance behavior [6,11,12]. In observational studies, where the observers are openly recording hand hygiene activity, a positive Hawthorne effect has been demonstrated [10]. In the New Zealand observation and audit study, where compliance was measured after a prolonged education campaign, appropriate hand hygiene episodes increased from 35% to 60% over 34 months [6]. However, there was variation between compliance in different professional groups. The authors noted that ''Changing culture among healthcare workers with respect to hand hygiene practices is an ongoing challenge'' [6]. Although signage to promote hand hygiene is common in clinical settings, only two studies were found that examined this specific human factors approach as part of their method [13,14]. In both cases, reminder signs had no [13] or a non-significant positive effect [14]. However, signage or visual cues continue to be a part of the organizations' attempts to promote appropriate behavior.

Medical students

In the HHNZ performance report published in March 2014, the overall compliance rate increased to 73.1% [15]. However, medical students and medical practitioners had the poorest hand hygiene compliance for health professional groups (70.8% and 63.8%, respectively) [15].

As part of our early clinical skills learning in a clinical skills center, medical students were introduced to the principles of hand hygiene, taught a hand-cleaning regimen and encouraged to apply it. Our hope was that students would develop the behavior in a controlled environment and then transfer their learning to the workplace. This transfer has been previously unstudied. Moreover, the effect of education or visual trigger materials in a simulated learning environment has not been evaluated. Thus, this study was set in an undergraduate clinical skills center and employed the human factors approach: modifying the environment with a visual cue in an attempt to influence behavior. Despite the equivocal findings in previous clinical studies, we felt that signs may have an impact in our setting for two reasons: there are no other signs at the workspaces and the students do not have the multiple environmental distractions of health care workers.

The aims of this study were to identify the effect of hand hygiene reminder signs on the use of antimicrobial hand gel and to reinforce hand hygiene educational messages that might assist in developing lifelong clinical habits.

Methods

Setting and subjects

The MBChB curriculum begins in year 2, with year 1 being a common health science foundation year. In years 2 and 3, students have regular clinical skills sessions at the Clinical Skills Centre (CSC) as part of their learning. In total, 240 students were enrolled in year 2 in 2012.

CSC sessions introduced the core skills of patient assessment. Students cycle through a series of skills blocks in year 2, attending in groups of 26—27 (nine repeats per block). During the first block of year 2, one of the learning activities is related to hand hygiene: students are introduced to its importance, the roles of water/soap wash and antimicrobial hand gel ('Microshield', Johnson & Johnson; North Ryde NSW, Australia) and they are given the opportunity to practice a local 20-s hand wash technique using authentic signage from the local district health authority. Students are expected to wash their hands using water and soap before subsequent sessions in the CSC and to use hand gel between peer, simulator or patient contacts; students largely learn using peer examination. Hand gel is provided at each workspace.

Study design overview

A single-blinded, cluster randomized controlled trial approach was used. The intervention was an unannounced visual trigger in the form of a hand hygiene reminder sign fixed to the wall at workspaces. The study took place in semester 2 in 2012. The outcome measure was the use of antimicrobial hand gel during sessions by measuring the before and after weights of all hand gel bottles in the room. Gel use was identified as a loss in bottle weight.

Study design detail

During one block in semester 1, the use of hand gel was monitored covertly by weighing all hand gel bottles at the start and end of sessions (Using Breville BSK500 electronic scales, 5 kg × 1 g; Sydney, Australia). Students were not aware of this baseline recording. In addition to the teaching sessions, the research team calculated the mean delivery rate for a typical pump action of the dispenser bottle. The raw data were collected by measuring the weight of 10 typical consecutive pump actions twice. These data provided a baseline for hand gel use. Usage includes two tutors at each session.

Figure 1 A5 sign used for the intervention group.

Before the start of semester 2, nine clinical skills student groups were randomly assigned to the intervention or control groups using counters drawn from a bag — five to the intervention group and four to the control group. The intervention was therefore at the level of the group and not at the individual. All of the students had the same hand hygiene learning experience in semester 1 and attended three sessions at the CSC.

For the intervention, A5-sized laminated color signs were produced to be placed above every workspace in the main CSC learning space. The signs had a photo of hand gel being dispensed and the text ''Please use antimicrobial hand gel'' (Fig. 1). They were fixed using Velcro, which allowed easy removal and fixing for the intervention and control groups. The control group experienced no change to the normal learning environment.

The study ran for two blocks of learning so that each student group attended the session twice. At the start of each session, the allocation of the student group was noted and the signs were placed or removed. For every session, all hand gel bottles were weighed and recorded at the start and end of the sessions. Data were entered into a spreadsheet,

which was managed by the CSC administrative assistant.

Apart from the signage, all of the other environmental and learning processes were equivalent across all sessions independent of study allocation.

Blinding and consent

Students were not informed of their allocation. The lead tutor at each session was aware of the allocation because they were responsible for the placement of the signs. Weighing of the bottles was performed by one of the tutors or other CSC staff. Evolving data on the spreadsheet were only seen by the administrative assistant until the completion of the study.

Students were not provided with an information sheet or asked to give consent. To do so would have un-blinded and confounded the study. The only change in practice was the addition of a visual trigger in the form of signs. Ethical approval was granted by the institution's Human Participants Ethics Committee to run a covert study. A requirement of the approval was that the students were informed of the study after the data collection was complete.

At the start of MBChB year 3, a debriefing sheet was sent by email to all of the students who took part in the study. This informed the students that the study had been running in semester 2. It described the method, explained why it was covert, offered the opportunity to ask questions, and informed them that a summary of the results would be available upon request.

Analysis

The mean hand gel use in grams per session and grams per person was calculated for both groups — intervention and control. Usage between groups was compared using *t*-tests and a mixed factorial ANOVA with three factors: hand gel use, group and the time point.

Results

Pre-study baseline phase

The mean dispensed weight of a typical pump action was 1.20 g, and the mean of 10 pump actions was performed twice.

The baseline usage data were collected in February and March 2012 during the teaching sessions. The mean use of gel per session was 35.50 g/session or 1.27 g/person (range, 0.85—1.75 g).

Study phase

In the control group, the mean session attendance was 26 students (range, 21—29 students); in the study group, the mean was also 26 (range, 18—29 students). The two sessions with low attendance were within a few days of the timetabled summative assessments in other modules. The skills session attendance sometimes falls around these times.

The mean total use of hand gel per session was not significantly different between groups: Intervention, 21.60 g (range, 12—34 g); control, 21.63 g (range, 7—47 g); $t = 0.005$; $p = 0.996$. When calculated as the mean grams/person, there was also no significant difference: Intervention, 0.83 g (range, 0.44—1.28 g); control, 0.83 g (range, 0.33—1.74 g); $t = -0.002$; $p = 0.998$.

The mean gel use between groups was compared over time as the mean grams/session and mean grams/person (Table 1). A three-factor ANOVA was calculated. Comparing time 1 to time 2, the difference between groups was not significant ($F = 0.019$, $p = 0.893$), but the difference between time points was significant ($F = 16.267$, $p = 0.005$). Assuming that the baseline measurement was applied similarly to both groups, a three-factor analysis between time 0, 1 and 2 was calculated. The difference between groups was not significant ($F = 0.009$, $p = 0.991$), but the difference between time points was significant ($F = 2.431$, $p = 0.001$). There was a decrease in the amount of hand gel used by both groups from baseline to their first and then second visit to the center during semester 2.

Discussion

In this study, we used unannounced hand hygiene reminder signs in an attempt to reinforce hand hygiene education messages and to develop appropriate behaviors. In the single-blind cluster randomized design, we found no difference in hand gel use between the two groups. Furthermore, there was both low use of hand gel and a decrease in the mean hand gel use over time for both groups. This is the first report of hand gel use with a behavioral intervention in a simulated clinical setting.

The low levels of hand hygiene compliance in our study correlates with the New Zealand medical student data found in the health sector audit covering July to October 2012 [16]. However, our findings

Table 1 Hand gel use over time by group allocation.

Measure of hand gel use	Allocation group	Baseline usage[a] (February/March 2012) (g)	Usage during first teaching block, semester 2 (g)	Usage during second teaching block, semester 2 (g)
Mean grams/ session	Intervention Control	35.50	27.25 28.00	16.00 15.20
Mean grams/ person	Intervention Control	1.27	1.03 1.02	0.62 0.64

[a] See Sections ''Study design detail'' and ''Pre-study baseline phase''.

are disappointing, and there is clearly a need to improve on creating hand hygiene behaviors in the early years.

The design of the study places some doubt over the value of signage to reinforce behavior — at least in our setting. As described above, the two studies in the clinical workplace that included signage as a part of their study also reported no significant effect. Signage, on floors as well as on walls, along with posters in the corridors are a mainstay of workplace hand hygiene reinforcement practice. Thus, this study suggests that they may be of little use unless hand hygiene practice is also being consciously reinforced. Although there have been no directly comparable previous studies, lessons from empirical studies in the clinical setting suggest that multiple approaches are required and that these approaches need to be sustained [1—6]. Feedback to staff from audits is likely to form a part of this ongoing motivation. From our experience, showing the results to the students who had participated was sobering and motivating.

There are a number of important limitations to this study. Students may reasonably perceive the setting as low risk and thus choose not to comply with hand hygiene. The perception of low risk may be due to the simulated environment, the fact that they largely learn through peer examination and that they have no exposure to real clinical environments in year 2 (apart from a half-day general practice visit). Soap and water hand-washing was not taken into account; thus students may have been using this cleansing approach. However, the learning space only had one two-person scrub sink and this was generally only used at the beginning of a session. It is not convenient for use during the sessions, and thus, the focus of the study was on hand gel cleansing between contacts at the work spaces. Although we calculated a per person gel use, the study data were collected at a group level. Thus, we do not know what influence the intervention had at the individual level — there may have been students who did change their behavior, but this change may have been lost in the group data. Individual data collection would have required several observers in the room, and this was not feasible. Observation is a common methodology in the clinical setting, and it would have been interesting to have had individual student data. We also assumed that the same baseline activity represented both the intervention and control groups as they were subsets of the original population.

One of our hopes is that increased awareness and the appropriate use of hand gel during simulated learning sessions will help to form habits that will transfer to the clinical environment. Future research should focus on effective interventions for sustained change in student behavior and transfer into the 'real world.' However, the HHNZ performance reports offer some encouragement; medical student compliance rates have increased from 54.3% in October 2012 to 70.8% in March 2014 [15,16]. Effort has been made in the MBChB program over this time to highlight the initial low performance and to promote the 'five moments'; some of these benefits may be observed in the HHNZ figures.

Despite the negative findings of this study, we have kept the hand hygiene signs in place. Tutors mention hand hygiene specifically at each session and draw attention to the signs when noncompliance is observed. This has been a pragmatic decision and is a part of a series of actions to raise the profile of hand hygiene at the center. As a result of the curriculum change, we were able to increase the number of student visits to the CSC in year 2 and have revised the learning activities. Students now have paired sessions where the first is learning the skills and the second is applying them in a way that promotes professional development. Tasks push students to take a professional role with simulated patients and peers. Reinforcing hand hygiene

has been embedded in this new approach. Simulated patients have been asked to provide feedback on hand hygiene compliance. A recent feasibility study in the UK indicates that empowering patients to ask health care workers about hand cleansing is a useful additional approach [17]. In our year 3 OSCE, failure to use hand gel results in a prompt and is reflected in the overall judgment. At year 2, our core skills test now includes a mark for hand cleansing.

Conclusions

Hand hygiene is a fundamental behavioral skill for clinical care. In our setting, this study indicates that this skill is not being generally acquired by early stage medical students. Other data show that student compliance has improved in the clinical setting since our study was completed [15,16]. We hope that this study encourages others to explore their teaching and learning of hand hygiene and to evaluate whether the behavior is transferred and becoming autonomous. Simulated and workplace settings need to reinforce hand hygiene training in a meaningful manner through multiple methods, including role-modeling, visual triggers, appropriate physical placement of hand gel in their environments and feedback. Additional research studies are needed to ensure that transfer is occurring between learning and clinical environments for health professional students.

Authors' contributions

AW conceived the study and all authors were involved in the design, data collection and analysis. The first draft was written by AW and all authors contributed to the revision. All authors approved the submission of the paper.

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Competing interests

None.

Ethical approval

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