The impact of structured incentives on the adoption of a serious game for hand hygiene training in a hospital setting

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Abstract. Hand hygiene is recognized by the CDC as the most effective method of preventing Hospital Acquired Infections (HAIs) which cost the US healthcare system $14 Billion. However, training and promotion of hand hygiene in healthcare settings is an on-going challenge. This paper describes a hand hygiene improvement campaign in Edinburgh Royal Infirmary (Scotland, UK) using the SureWash gesture recognition system (SureWash, IRL). The campaign consisted of two phases of three-months each; the first phase involved technology evaluation and familiarization in a variety of settings within the hospital. The second phase involved rotation between two units with specific changes to the incentives for completing the training. There were 2,010 individual training sessions with over 30% outside of office hours. Individuals completed an average of 2.72 training sessions each and 90% of staff passed the assessment. Senior staff noted a change in hand hygiene culture following the campaign and the good-natured competition between staff to demonstrate hand hygiene competence using the SureWash serious game. While the new technology did facilitate the culture change its successful implementation was dependent on a set of incentives for staff and a structured implementation plan.

Keywords. Gesture recognition, hand hygiene-training, gamification

1. Introduction

The Royal Infirmary of Edinburgh (RIE), which is part of NHS Lothian, is a major acute teaching hospital provides a full range of acute medical and surgical services and has the busiest Accident and Emergency (A&E) department in Scotland. Hand hygiene is the single most important factor in helping to reduce Healthcare Associated Infections (HAI)[1]. At the end of 2013 there was an increased incidence hospital acquired infections. RIE decided to use the SureWash interactive gesture recognition system (SureWash, IRL) in order to re-engage and motivate staff in hand hygiene. To successfully implement the campaign the technology was first evaluated in a number of settings so as to develop the structured elements of campaign.

SureWash is a cart based kiosk e-learning system that can be positioned in clinical areas making hand hygiene training accessible to staff 24 hours a day 7 days a week. SureWash uses a camera and patented gesture recognition technology to objectively measure a user's skill in hand hygiene technique. Users get real-time

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feedback on their technique allowing them to training independently. Furthermore multiple-choice quizzes are set to target specific areas of knowledge for improvement. SureWash provides Infection Prevention and Control mangers with reports of staff competence in hand hygiene technique and on their engagement level with the training. SureWash has been validated in a number of clinical studies [2][3].

Figure 1. SureWash in a Hospital Setting

1.1. Technology implementation

The difficulties of implementing behavior change in clinical practice have been noted for some time and similarly using technology in education requires a structured implementation plan. We have used key research on technology deployment in healthcare[4] and behavioral economics[5] to develop our implementation plan.

For hand hygiene promotion the World Health Organization (WHO) developed a multimodal hand hygiene improvement strategy that calls for five key components: System change, Education and Training, Evaluation and Feedback, Reminders in the Workplace and an Institutional Safety Climate[2].

Table 1. Mapping WHO patient safety themes onto hand hygiene actions in Royal Infirmary Edinburgh

WHO Patient Safety Themes	WHO Hand Hygiene Actions	NHS Lothian actions
System change	Access to wash basins, soap and towels Alcohol gel at the point of care	Sinks and gel at point of care
Education & Training	Regular training on hand hygiene to all health-care workers	SureWash training
Evaluation and feedback	Monitor hand hygiene practices	Observational Audit & SureWash assessments
Reminders in the workplace	Promote hand hygiene	SureWash is a interactive reminder on the unit
Institutional safety climate	Raise awareness of patient safety among staff and patients	Mangers remind staff when they missed training. Patients and visitors also use SureWash

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[2] http://www.who.int/gpsc/5may/Guide_to_Implementation.pdf

2. Method

The implementation team was made up of senior infection control staff and members from SureWash. Together an implementation plan was developed to cover a 3-month first phase and if successful a further 3-month second phase.

The first phase started in mid-January 2014 SureWash was introduced to A&E staff in a training room setting and used as an educational tool. In February 2014 SureWash was moved onto the ER unit, unit 107 and unit 105 and in March it was moved to the Out-patients Departments OPD1 and ODP2. Staff were encouraged to use SureWash and all their interaction was tagged by their location but were otherwise anonymous. In February and March a series of interactive educational visits were organized to promote the use of SureWash.

During the first phase there was good acceptance of SureWash and nursing managers observed positive changes in hand hygiene practice hand hygiene culture on the wards visited. Based on this success and the observation of staff behaviors a number of changes were implemented for the second phase:

- **Promotion and Preparation**: Interactive training events were arranged bi-weekly to promote hand hygiene training and break down any barriers to use.
- **Individual responsibility**: Anonymous login was removed from the system and all staff were provided with individual training records on SureWash. Staff were informed that they were responsible for completing their training and logged into the system using their hospital ID card.
- **Rotation between test sites**: Two units were selected for the evaluation: A&E and the Clinical Assessment Unit (CAU). In order to use scarcity as a driver for engagement SureWash initially spent 3 weeks on each unit and then spent a further week on each unit as follow-up.
- **Senior Leadership**: A bi-weekly report of staff who missed training was generated for managers. These staff were then reminded by their manager to complete their hand hygiene.

3. Results

Over the entire period of the implementation it was noted that SureWash was used at all times of the day. Over 30% of interactions were outside of 9am-5pm. **Figure 2** show the number interactions with SureWash and how they were distributed across the day.
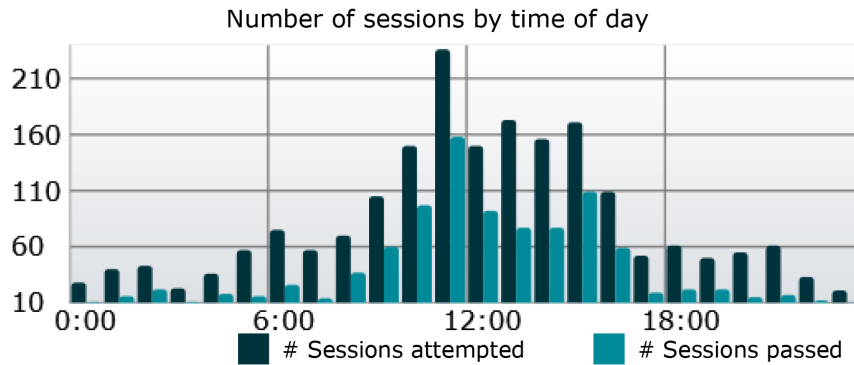
Figure 2 The time distribution of interactions with SureWash

Over the entire implementation plan there were a total of 2010 interactions with SureWash, 43%[856] during the preliminary phase and 57%[1154] during the main implementation phase. However, these numbers are not directly comparable as there were a greater number of wards in the preliminary phase. Table shows the data on the number of interactions per month and average score achieved for each of the poses. It should be noted that the intervention only began on January 14th and that in February the unit was placed on the wards and interactive educational visits were also introduced. In April the impact of individual responsibility of and reminders from senior staff drove up the number of interactions. It is also clear that the competence of the staff on the poses also increased over time, it is particularly noticeable that when staff became individually responsible for passing the average scores substantially improved.

In the second phase 419 unique users interacted with the system and achieved a 90% pass rate for hand hygiene. There were a total of 1154 interactions during the same period giving an average of 2.72 interactions for each user.

Table 2 Average Pose-by-Pose scores over all interactions January to June 2014

Number of uses by month	Pass Rate on Pose 1	Pass Rate on Pose 2	Pass Rate on Pose 3	Pass Rate on Pose 4	Pass Rate on Pose 5	Pass Rate on Pose 6	Pass Rate on Pose 7
January 132 uses	94%	71%	89%	87%	69%	82%	87%
February 479 uses	95%	76%	88%	88%	46%	69%	75%
March 245 uses	98%	74%	90%	91%	61%	80%	78%
April 287 uses	96%	93%	97%	90%	80%	86%	89%
May 610 uses	97%	92%	96%	93%	84%	86%	89%
June 257 uses	98%	90%	97%	93%	82%	89%	91%

4. Discussion

The evolution in the use of SureWash over the course of this study has reinforced the importance a multi-modal technology implementation plan when promoting a change in hand hygiene culture. The SureWash technology provided some elements of these: interactive and accessible education, reports on the engagement with training and it acted an actionable reminder of hand hygiene education on the ward. However, other elements of the implementation plan were also critical, interactive educational visits to promote training, a culture of individual responsibility for hand hygiene training and the leadership of senior staff in following up with staff who had not completed their training.

Front line engagement was important in getting staff to under take training, a good-humored competition based on peers achieving an assessment score of 100%. SureWash was often used at break times his can be see in the time of day data with peaks at 11am, and lesser peaks at 1pm and 3pm. Placing SureWash onto the wards had an immediate effect on engagement in a wider variety of staff interacted employees with more frequent use.

The quality of the engagement and completion rates of training increased substantially when anonymous login was removed and staff were provided with

individual training accounts. This was a significant statement about the change in hand hygiene culture: staff became solely responsible for completing training. Senior leadership was evidence by having managers note and follow up with staff who missed training or who hand inappropriate hand jewelry or nail varnish.

Managers reported witnessing a change in behavior with staff "carrying out the WHO technique instinctively" following the intervention. The emphasis on hand hygiene training and assessments is also creating a wider awareness on hand hygiene. In the words of one manager– "hand hygiene went from being a must do boring subject to being popular overnight!"

The data in Table 2 shows that staff competence in the different parts of the WHO technique improved over time. Manager's observations confirm that this data has translated into clinical practice.

The overall objective to develop a scalable campaign to improve the culture of hand hygiene in NHS Lothian has been successful and sure wash has been deployed in 4 sites. While novel technology has allowed staff to take individual responsibility for hand hygiene training and for training to be readily accessible on the ward 24/7 the success of the intervention still requires the supporting context of an overall implementation plan, which involves interactive education, and the leadership of senior staff.

5. Acknowledgements

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