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## Project Final Report

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### 'In Their Hands: Students outcomes and experiences with Gesture Recognition System for handwashing'

#### Team members:

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This report outlines the outcomes of our PTAS-funded study to evaluate the Surewash® system as an accessible educational training tool for veterinary students.



Hand hygiene is an important step in the prevention of infections across patients, students and staff within both human and veterinary hospitals. Despite regular training, compliance with the hand washing protocol has been shown to be an issue across students in all years of the undergraduate Royal (Dick) School of Veterinary Studies (RDSVS) programme. The RDSVS adopts the National Health Service (NHS) clinical hand hygiene protocol which is an adapted version of the World Health Organisation guidance and includes the cleaning of wrists for clinical work (See Appendix A for a copy of the current hand rub protocol).

The Surewash® machine is a standalone educational aid that uses gesture recognition software to allow users to learn and practice the NHS Hand Hygiene steps. The machine records each step of the process, including steps that were found to be difficult (time taken is used to assess this) and provides a downloadable report to allow hospitals to monitor compliance.

#### Research Questions

**Will the students use the Surewash® machine to practice hand hygiene?  
What steps of the hand hygiene process do they find difficult?**

#### Using Surewash

The Surewash® Machine involves placing hands onto a template, then completing the seven steps of the NHS hand hygiene protocol. The machine monitored the movement of hands to assess for correct rotation and placement of the hands for each step. During each step there was a progress bar on the screen, students could observe if they were performing it correctly and then make small adjustments to make their rotations more effective. Each step was timed, including both left and right hands, and an average time was provided at

the end. Should a student struggle with one particular step this was highlighted to them at the end. They could also skip the step if they were unable to complete it, however this counted as a fail. Should a step take too long, the machine would move onto the next step and this resulted in a fail of the procedure. Students had approximately 20 seconds per step before the Surewash® machine would move on.

## **Methodology**

This project was split into two studies:

Study A invited the Year 1 students (via e-mail and verbal endorsement in class) to use the machine in the week prior to sitting their hand washing exams.

Study B introduced Infection Control Ambassadors in each year to promote the Surewash® training tool and introduce a competitive element to encourage all years to take part.

### **Study A**

During Study A, the Surewash® machine was stationed in a high throughput area of the R(D)SVS teaching building, and Year 1 students were emailed inviting them to use the machine to practice for their exams. The academic member of the team who teaches Hand Hygiene during a formal taught class also introduced the year to the machine via verbal endorsement. Details were then recorded by the Surewash® machine each time it was used.

### **Study B**

At the RDSVS the undergraduate students on campus range from Year One to Year Five and 'the Graduate Entry Programme (GEP)' year. The RDSVS runs two programmes of study – Undergraduate and GEP. The Undergraduate programme lasts five years, with their first two years of study separate to the first year GEP. The two programmes merge and students complete their last three years together.

Students were invited (via email and at the start of lectures) to become Infection Control Ambassadors (ICA) for their year. With the exception of Year Two, where one student was randomly selected from multiple applicants, only one student per year volunteered to become an ICA. ICAs were provided with a project t-shirt and the chance to win an ipad to introduce a competitive element. Due to the nature of final year, it was agreed that the study would not include Year 5 students, as many were not on campus for the duration of the study.

The Surewash machine offers 3 levels of 'gaming', with each level increasing in difficulty (level one shows an image of the hand hygiene step to demonstrate it, and the information is reduced as each level is progressed). One – to –one training was given to the ICA's by Caroline Mosley and the project was run over a four week period. ICA's were encouraged to get as many students in their year

as possible to use the machine repeatedly, although progression through the levels was not necessary.

## Results

### Study A

The machine was used a total of 98 times over a 7 day period prior to the year one hand hygiene examination. The results identified that less than half of attempts (43%) passed the hand hygiene steps and that students opted to use the 'Visitor' access (n=60) rather than type their name into the machine. A key logistical finding of this study was the identification that many students selected the 'visitor' option when logging into the machine as the sign in option was too time consuming, and as the visitor access was available for anyone, it is impossible to determine how many users were students or how many student used the machine on more than one occasion,.

This study therefore allowed us to identify a key constraint in terms of identifying individual users, and enable the project team to alter the log-in procedure prior to the launch of the larger Study B. A swipe access was installed onto the machine, to log individual student card numbers.

### Study B

The machine was used a total number of 304 times, with 94 unique users. Across the year groups, the GEP students engaged the most with an average of 5.9 attempts per student and 67% of the GEP year (n=52) logging in to the machine at least once to use it (Fig 1). Across all years, 33 students who attempted to use the machine did not continue until they passed all steps satisfactorily, of these students 9 were from Y1. The Y1 students had recently sat their hand hygiene exams and had been introduced to the machine earlier in the Semester, yet out of 15 Y1 students who used the machine only 6 were successful in passing all of the required steps in the procedure.

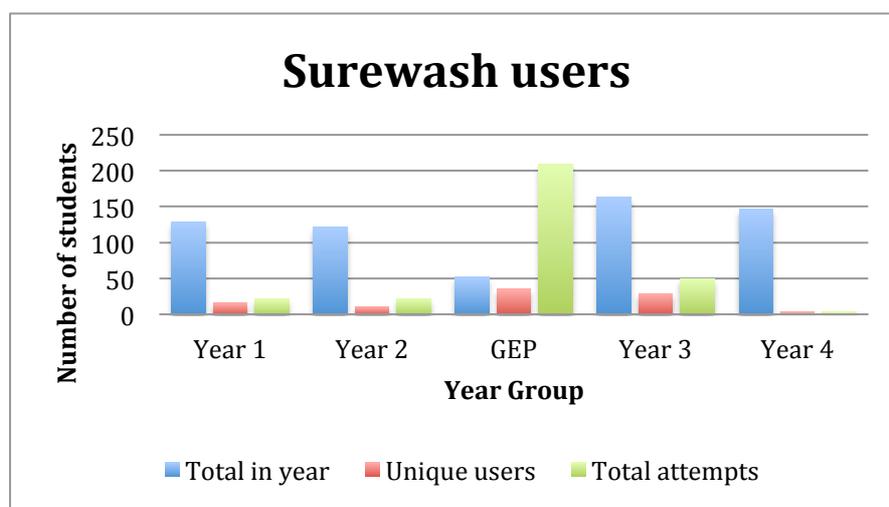
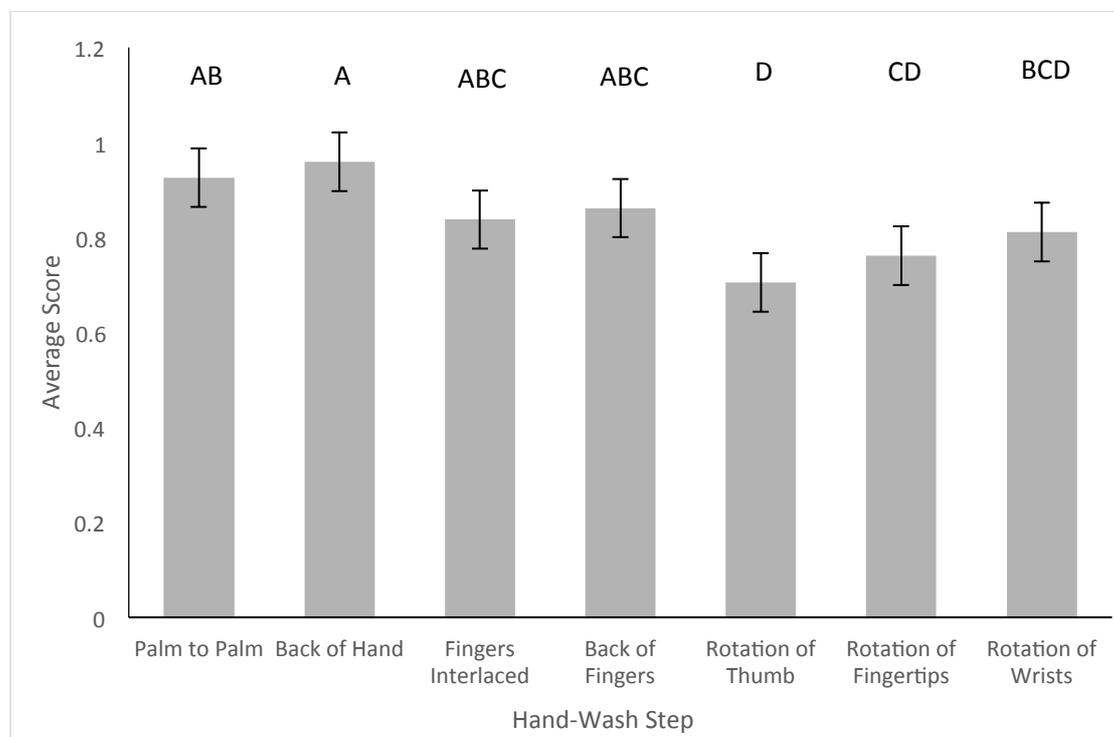


Fig 1: Summary of Surewash® users by year. The x axis shows the total number of students within each year cohort, total number of unique users, and total number of individual attempt broken down by year of study. The y axis shows the total numbers within the student year, the total attempts at the surewash machine and the number of unique users per year

Analysis of data using a one way-ANOVA test demonstrated a significant difference in overall performance across year groups ( $F^{3,566}=4.08, P=0.007$ ), and a Tukey's post-hoc test showed that Y2 performed significantly better than Y3 ( $T=-2.87, P=0.022$ ). However the difference in overall performance between Y1 and GEP from Y2 and Y3 was not significant and exploring what causes these differences between years will be an interesting avenue of exploration for the planned future study.

The Surewash process relied on seven steps being conducted and across all year groups there was a significant difference in performance across these steps when data was analysed using a one-way ANOVA test ( $F_{6,566}=7.96, P<0.001$ ). Step 5, 'Rotation of Thumb' was the step which showed the lowest scores, whereas Steps 1 and 2 'Palm to Palm' and 'Back of Hand' were relatively high scoring across all year groups (Figure 2). Note that 'give up' attempts were not counted in this analysis, and so this may be indicative of a lack of understanding of the mechanics of these steps, or a sensitivity issue of the gesture recognition capability of the Surewash machine instead.



**Figure 2:** Comparisons of mean score for all students across hand-wash steps. Mean score is calculated per step, with 0 being an entirely unsuccessful step and 1

*being an entirely successful step. Mean values that do not share a letter are significantly different according to Tukey Post Hoc tests at a level of  $p=0.05$*

## **Project Outputs**

<b>School</b>	<b>Detail</b>	<b>Date</b>
VMED Symposium, R(D)SVS	Poster presentation to R(D)SVS and other U of Edinburgh colleagues on the Surewash project	Edinburgh, June 2016
<b>National/International Conferences</b>		
VETED 2016 conference	Short communication/poster	Glasgow July 2016
<b>Publication</b>		
Journal of Veterinary Medical Education	*manuscript in preparation	

## **Future Work**

Following the first projects, a third project aimed at staff in the Hospital for Small Animals was carried out, data from this is expected to be used for internal training and second publication.

In a future study we intend to investigate the difference in performance at different times in the year to explore evidence of learning with repeated use of the machine, and to establish if the differences in year groups can be attributed to poorer performance in certain stages.

We are also considering the use of focus groups to explore user attitudes to the machine and their confidence in hand hygiene protocols.

As most students found the rotational steps of the handwash process to be the most difficult, this is perhaps due to the design of the machine, or technique issues across students. A focus group to explore this further will be a useful next step.

Introducing an annual hand hygiene assessment in the students clinical skills portfolio has been considered, however the cost to hire and purchase the machine long-term is prohibitive.

In the PTAS award, it was suggested that the project could consider a comparison between Surewash and other less expensive options. This is under review, however no other training systems have been identified that would allow a student to have repeated access to gain feedback on their practice.

## Appendix A



THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies

### Hand Rub Technique with Alcohol Gel



1 Apply sufficient alcohol gel to a cupped hand to cover all surfaces



2 Rub hands palm to palm



3 Rub back of each hand with the palm of the other hand with fingers interlaced



4 Rub palm to palm with fingers interlaced



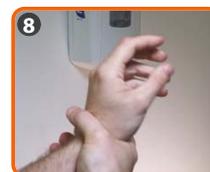
5 Rub with back of fingers to opposing palms with fingers interlocking and vice versa



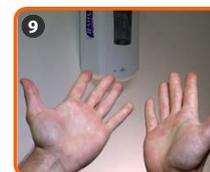
6 Rub each thumb clasped in opposite hand using a rotational movement



7 Rub tips of fingers in opposite palm in a circular motion



8 Rub each wrist with the opposite hand using a rotational movement



9 Allow hands to air dry

\*\* Steps 2 to 8  
require a minimum  
of 3 repetitions



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