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Using AI to improve the quality and quantity of hand washing in hospitals

Poor quality hand hygiene has been identified as the main contributor to the spread of hospital acquired infections. In the USA, they affect 2 million patients of which nearly 90,000 die. The cost of these infections is US$28-35 Billion per year.

Many studies investigate the number of hand hygiene events in hospitals but only a few studies investigate hand hygiene quality. But does the quality of hand hygiene matter? It turns out that how we clean our hands is very important for removing potentially lethal microbes. Award winning research by Jacqui Reilly in the UK showed that even partial completion of the World Health Organization (WHO) hand hygiene technique delivers a significant reduction in the number microbes on the hands. When hand hygiene quality was examined in hospitals they found only 8% to 15% of people following the WHO technique. So, if using the WHO hand hygiene technique really matters, how can we improve practice?

Fig. 1. The SureWash AI Tutor over a hospital sink.

Frequent short training workplace-based sessions have been shown to be effective and have led to reductions in infections. However, this approach is very labour intensive. Our objective was to investigate whether installing an Artificial Intelligent (AI) tutor over hand hygiene sinks could improve the quality and quantity of hand washing.

Our SureWash AI tutor consisted of a small computer that analysed a video of the person washing their hands and provided them with real-time feedback. The screen showed each step of the WHO method, each with a red / green traffic light symbol. As the healthcare worker completed each step of the method, the associated traffic light changed from red to green. This became a type of game as people tried to get all the traffic lights to turn from red to green. In order to ensure anonymity, the video camera faced straight down showing only the sink area, thereby excluding the face or any other identifying information.

Our study measured the quality and quantity of hand washing over a 4-month period. The AI tutors were placed above all 8 hand hygiene sinks in a hospital ward. In total 3,606 hand wash events were used in the study. As it was a busy surgical unit the number of patients and staff varied daily with a peak on Tuesdays and a minimum over the weekend. To address this, we calculated the number of hand hygiene events per patient per day i.e. total number of hand hygiene events per day divided by the number of patients that day.

We measured quality using the percentage of hand hygiene events that met the full WHO protocol i.e. total number hand hygiene events which turned all the “traffic lights” green, divided by the total number of hand hygiene events. We verified the accuracy of the AI using two human observers.

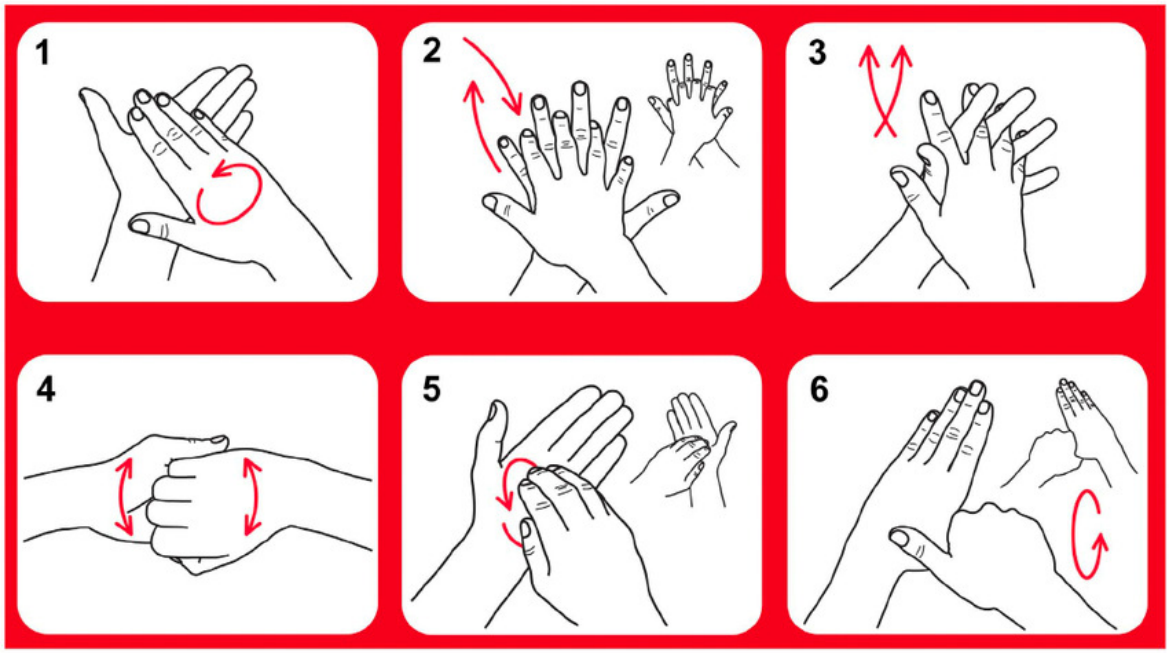

Fig. 2. The World Health Organisation technique for hand hygiene in hospitals.

We found that when the AI tutor was used, the quality of hand hygiene improved from 15.7% to 46% and the number of hand wash events per patient per day increased from less than 1 per day to over 2 per day. However, when the feedback screen was turned off, performance reverted to the level it had been before using the AI tutor.

An interactive AI tutor can significantly improve the quality and quantity of hand washing. However, it is clear that we can easily become dependent on our technology. Our future research will be to investigate how we can promote less dependence on the technology by having the AI tutor vary between providing help and testing performance.

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Publication

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