Is it time to rethink hand hygiene monitoring?

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BACKGROUND

Low hand hygiene compliance (HHC) at hospitals continues to be a problem[1] and the accuracy of HHC monitoring is still a challenge[2]. Direct observation of hand hygiene is standard practice but is limited by the Hawthorne effect and interobserver variation[3]. In addition, the method is time consuming, labor intensive and captures only a fraction of the total hand hygiene events.

There have been many significant improvements in technologies over the years, but the healthcare sector has not exploited these opportunities. Automatic monitoring of HHC is now possible and allows continuous data collection and analysis. Importantly, the Hawthorne effect is mitigated and required human resources are minimal[4].

OBJECTIVE

The first important step to improve HHC is to get insight into data, trends and behavior. Therefore, we aimed to monitor HHC using a real-time location system specifically designed for hospitals (sani nudge™)[5]. In addition, we aimed to look into different situations where HHC was particularly low and work with hospital staff on improving these cases.

METHOD

The sani nudge system™ was installed at two hospital wards and used sensors to monitor sanitizations **(Fig. 1)**. In addition, specifically designed algorithms, based on WHO's 5 moments for Hand Hygiene and local hospital guidelines and practices, were used to calculate the HHC[6]. The system monitors WHO moments 1, 4 and 5. The daily trend of HHC was recorded on a continual 24-hour basis between February 2018 and September 2018. This study focused on hand hygiene using alcohol-based sanitizations.

A total of 79 staff members (nurses, n=73; doctors, n=6) were taking part in the project. The majority of ID-sensors were given to nurses because they work routinely in the wards and have high number of patient interactions which enabled the study to examine the hygiene behavior according to daily ward activity.

RESULTS

During the study period, the system registered 2.2 million data points equating to 127,601 direct observations and an average HHC of 46%. Interestingly, most patient contacts occurred from 5am to 2pm, but the lowest HHC was between 9pm and 4am.

We found a disparity in HHC rates according to the room type with the lowest HHC in patient bedrooms (36%) and the highest in staff toilets (80%). In the patient bedrooms, the hospital staff had a higher tendency to sanitize hands after patient contact rather than before patient contact **(Fig. 2)**. In line with this, we found that HHC was highest in rooms that were often considered dirty **(Fig. 3)**. For example, there was a lower HHC in the medicine room **(Fig. 3a)** compared with staff toilet **(Fig. 3b)** and rinsing room **(Fig. 3c)**.

We found that with the system fully integrated, the hospital staff worked to maintain a constant level of good hand hygiene **(Fig. 3d)**. Fluctuations in HHC rates between days became smaller and a general upward trend could be seen. In addition, rooms that had low HHC at the start of the study, such as staff toilets, improved to show a steady high level of compliance week on week.

By using this monitoring system, instead of direct observation, this study can also look at HHC in all rooms at the same time using a heatmap **(Fig. 4)**. The heatmap provides an overview of rooms with high vs. low HHC, thus helping the wards and hygiene nurses to direct the resources to where it is most needed.

CONCLUSION

HHC can successfully be monitored using a computerized system. Interestingly, we found the lowest HHC during late evening/night and in patient bedrooms, especially before patient contact. This data-driven approach enables hospitals to have precise, accurate and real-time compliance rates and gives important insights into hygiene behaviors and helps identify areas that need to be improved. As a result, tailored hygiene campaigns can be created that specifically address these areas. In future studies, we will use the system to investigate HHC of patients, visitors and different staff groups while using the data actively to improve HHC.

Figure 1. Illustration of the sani nudge™ system

HOW THE SYSTEM WORKS:
1. Detect: The sani ID continuously shares each employees' hand hygiene opportunity to our system. **2. Record:** The sani sensor records all dispenser usage and nudges to remind whenever compliance drops lows. **3. Interaction:** The patient sensor creates a zone around the treatment area to detect whenever patient contact has occurred. **4. Share:** The sensors anonymously record and send the data from all events to our secure server.

Figure 2. Hand hygiene compliance in patient bedrooms stratified according to patient contact

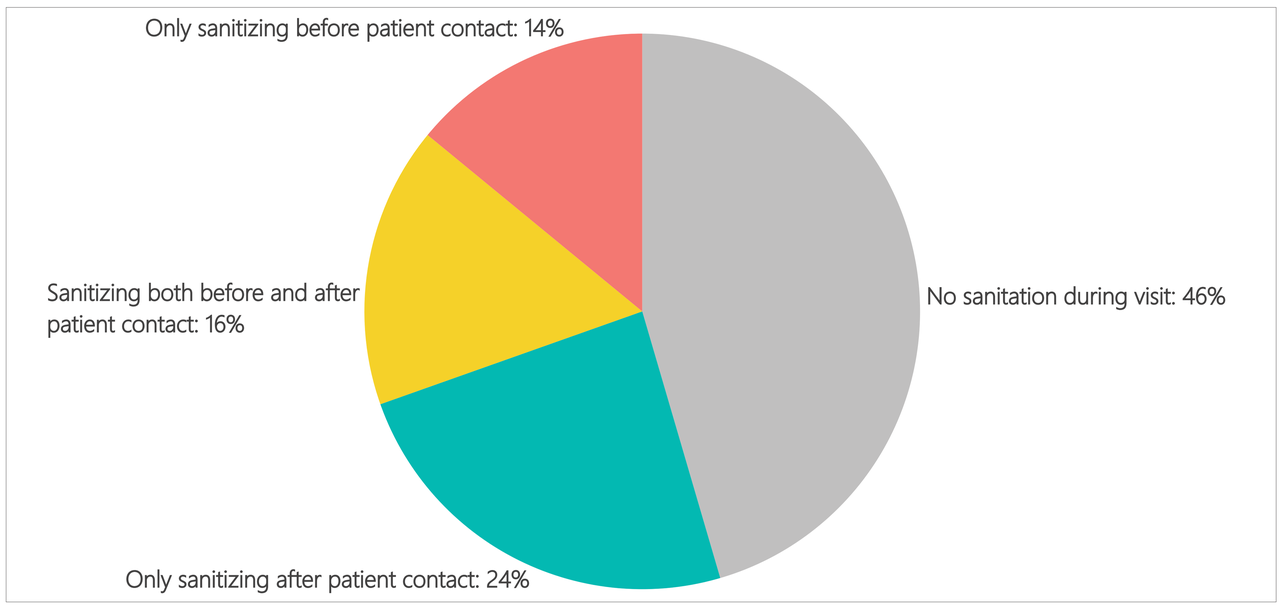


Figure 3a: Hand hygiene compliance in the medicine room

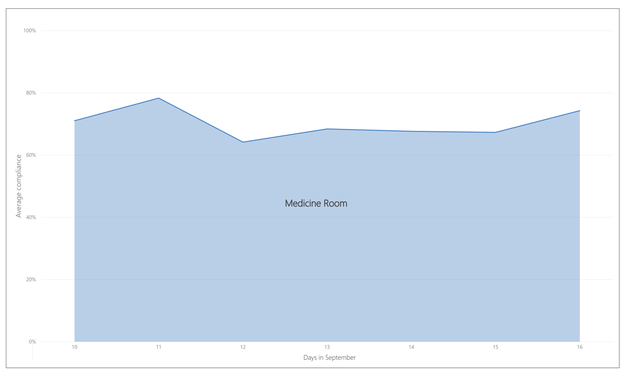


Figure 3b: Hand hygiene compliance in staff toilets

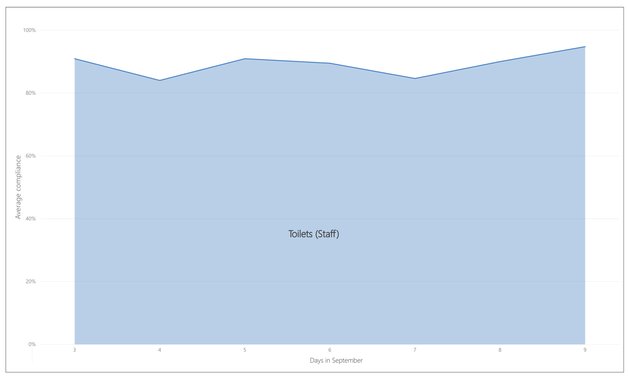


Figure 3c: Hand hygiene compliance in rinsing rooms

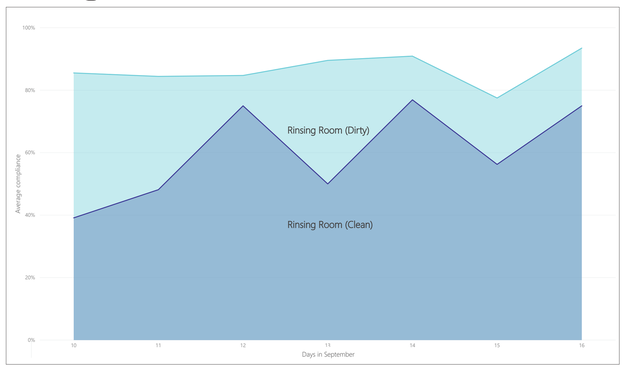
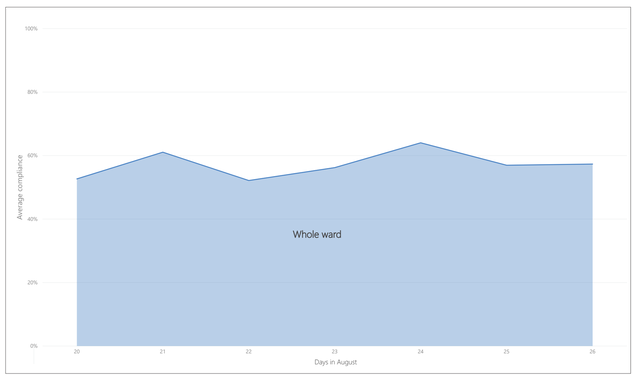
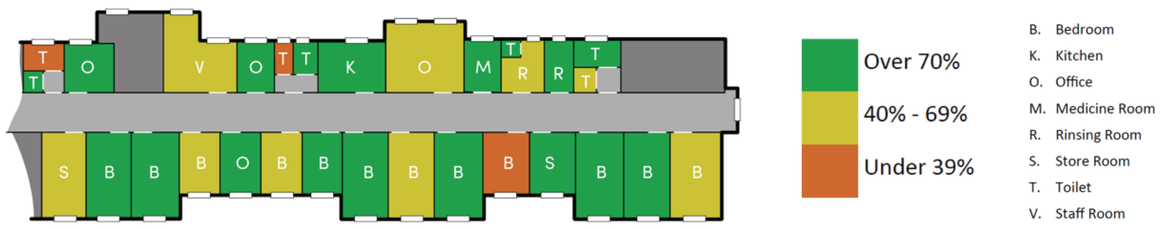


Figure 3d: Total hand hygiene compliance in the whole ward



Data are provided as means and illustrated at a random period for simplicity.

Figure 4: Heatmap for hand hygiene compliance



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