



Building and Testing a Device to Monitor and Improve Hand Hygiene Compliance in Hospital Care

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Introduction

Hand hygiene compliance before and after each patient contact is one of the most fundamental and essential components of patient care. However, it has been found that without encouragement to perform hand hygiene, health care workers hand sanitize as little as 30% of the time that they interact with patients (Hartocollis 2013). This can make patients more susceptible to hospital-acquired infections, which costs the health care system \$30 billion and leads to nearly 100,000 deaths each year (Hartocollis 2013). Although hand hygiene has been continuously studied and various high-tech solutions have been offered for monitoring healthcare workers, substantial and lasting effects on compliance rates have been minimal and current solutions are not widely used due to their steep price and limitations (Boyce 2011; Erasmus 2010). The aims of this study were to build and test a system to monitor and remind health care workers and visitors to perform hand hygiene before entering and exiting a patient's room.

Methods

A prospective study was conducted in one patient room in the neuroscience intensive care unit of Zale Lipshy University Hospital, Texas. We designed and built a hand hygiene monitoring system using widely available electronic circuit parts from LittleBits™ electronics (Figure 1). The device consisted of three motion sensors: one placed on the stationary hand sanitizer dispenser located directly outside the patient room (Figure 2), one placed on the stationary hand sanitizer dispenser located inside the patient room (Figure 3), and one in the doorway of the patient room (Figure 4). The three sensors were configured to detect if entrance into or exit from a patient's room was immediately preceded by use of the local hand sanitizer dispenser. The device also used an audio and visual reminder that was initiated for a set period of time whenever a subject failed to initially hand sanitize (Figure 5). A cloud-based method was used to transmit and record data from the device over the Internet onto online Excel spreadsheets based on whether the person entering or exiting the patient room was compliant or non-compliant in hand hygiene. Compliance was defined as subjects hand sanitizing either immediately before entering or exiting the patient room or within the set time period that the audiovisual reminder was given. Although compliance and non-compliance rates were recorded, the device did not track the individual identities of those entering and exiting the room. The functionality of the device was tested through a direct observational period, after which observational data were compared with data recorded by the device itself.

Results

Our device was able to monitor and record hand hygiene compliance in a high percentage of health care workers and visitors. Out of 100 observations, 73 were recorded by the device as compliant and 27 as non-compliant. Of the 73 compliant cases, 2 were actually non-compliant; of the 27 non-compliant cases, 5 were actually compliant. Sensitivity was 93% and specificity was 92%. The device was able to differentiate compliant from non-compliant subjects entering or exiting the patient room, initiate an audiovisual reminder, and automatically transmit and record the data onto Excel spreadsheets.

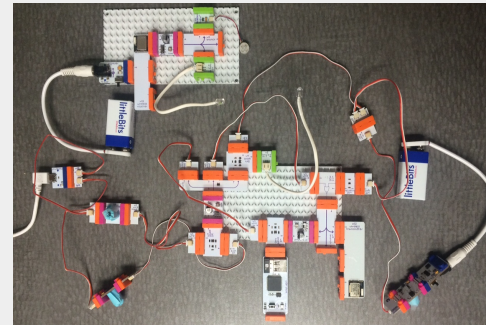


Figure 1. The basic electronic configuration of the device.



Figure 3. Motion sensor on dispenser inside patient room.

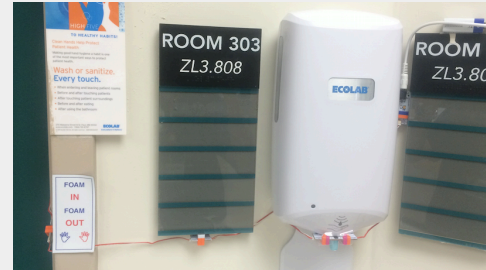


Figure 2. Motion sensor on dispenser outside patient room.



Figure 5. Audiovisual reminder placed inside patient room.

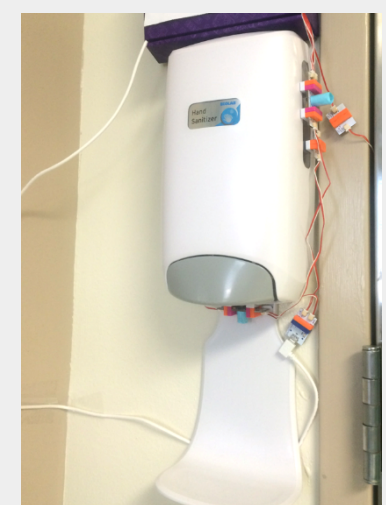


Figure 4. Motion sensor for doorway of patient room.

Conclusion

Our study shows that hand hygiene compliance in hospital care can be monitored with a low cost, non-invasive, and easy-to-build electronic device that overcomes the cost and functional limitations posed by existing solutions. Future studies will continue to look at the long-term effect of an audio and visual reminder on increasing hand hygiene compliance in hospital care.

References

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