

Increasing Hand Hygiene during a Pandemic: Design, Construction, and Implementation of a Gamified Hand Sanitizer Feedback Unit

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Introduction: In the absence of effective pharmaceutical interventions to combat COVID-19, non-pharmaceutical interventions including hand washing has remained one of the key methods to decrease spread of both COVID-19 and all healthcare-associated infections. Prior literature has repeatedly demonstrated that healthcare workers' hands remains the main method of transmission behind healthcare-associated infections. Despite widespread acceptance of the necessity of handwashing, hand hygiene at hospitals remains inadequate. Gaube et al. 2018 demonstrated that gamification of hand hygiene resulted in substantial long-term improvement of hand hygiene.

Objective: We have designed, programmed, and 3D-printed a hand sanitizer feedback unit (called "Happy Hands") that gamifies hand hygiene. The purpose of "Happy Hands" is to catch the attention of nearby individuals and to motivate them to utilize proper hand hygiene.

Methods: "Happy Hands" acts as a supplementary module to existing wall-based hand sanitizer units. It uses an Esp32 microcontroller and multiple ultrasound sensors encased in a 3D-printed enclosure with a printed circuit board to detect whenever a person uses or ignores a hand sanitizer unit. "Happy Hands" displays a red frowny face whenever it detects people nearby. It displays a green smiley face whenever a person utilizes the unit. The 3D-print was designed using Tinkercad while the printed circuit board was designed using EAGLE. "Happy Hands" units have been implemented at Augusta University Medical Center.

Results: "Happy Hands" represents the successful gamification of a hand sanitizer unit that provides visual feedback to its users. These units are inexpensive, can be adapted for multiple hand sanitizer units, and gamify hand hygiene. Psychological research has repeatedly shown even simple incentivization can significantly improve hand hygiene when combined with gamification and positive reinforcement. These units also allow quantification of hand sanitizer usage, providing additional benefits. First, these units can help monitor the efficacy of further efforts to increase hand hygiene by tracking the extent to which usage of hand sanitizer units has increased after adoption. Second, comparing the relative use of each unit across a building or across a day allows compliance officers to monitor which departments are most in need of supplementary hand hygiene campaigns. Our next steps include measuring and increasing compliance for healthcare providers at the Augusta Health Hospital System. As a successful gamification of hand hygiene, "Happy Hands" likely represents both a useful non-pharmaceutical intervention against COVID-19 and a cost-effective preventative measure against hospital-associated infections and future pandemics.