



## Short Report

# New shine on an old habit: a pilot study on a glow soap faucet system

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## SUMMARY

Proper handwashing technique and consistent compliance reduce healthcare-associated infections. A recently developed glow soap faucet system (GSFS) illuminates a fluorescent soap, thereby allowing users to visualize glow soap coverage and removal in an engaging manner. A GSFS was placed in a medical training facility, and healthcare worker reception was very positive; 93% reported that a GSFS would 'probably' or 'definitely' decrease infection rates in workplaces similar to theirs ( $N = 136$ ). Further, a handwashing study of non-medical participants found that GSFS washes left  $3.1\times$  fewer bacteria on hands compared with standard washes (bacteria log<sub>10</sub> reduction of 2.1 vs 1.6;  $P < 0.01$ ).

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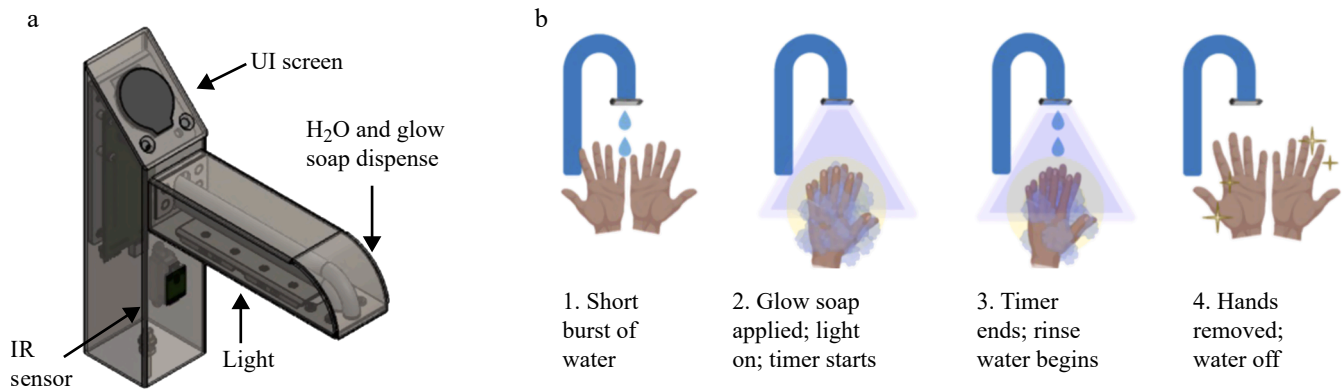
## Introduction

Handwashing with soap and water is a simple and effective way to prevent the spread of diseases including healthcare-associated infections (HAIs), yet universal adoption remains elusive [1]. As such, many interventions are employed in healthcare settings to improve both wash quality and ongoing compliance ranging from simple paper fliers to elaborate electronic hand hygiene (HH) monitoring systems [2].

Recently, an HH startup company, Abluo Inc, developed a glow soap faucet within the tech incubator Minnetonka Labs. The faucet head incorporates a deep-blue light (405 nm) and dispenses a fluorescent soap to create a visually engaging handwash experience. This tool echoes the common Glo-Germ lotion intervention used in schools, aged care facilities, and medical centres, but allows every wash to be visualized instead of just training washes. The head of a glow soap faucet system (GSFS) is shown in Figure 1a. The wash sequence of a GSFS is configurable, but a typical sequence begins when an infrared sensor activates a brief stream of water before liquid soap containing a fluorescent agent is dispensed (Figure 1b). A deep-blue light excites the fluorescent agent, allowing users to easily

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**Figure 1.** Overview of a glow soap faucet system (GSFS). (a) CAD schematic of a GSFS. (b) Steps of a standard GSFS handwash.

visualize the quality of lathering on their hands. A displayed timer counts down for a preset duration (e.g., 20 s). After lathering, water is provided for rinsing, and users visualize glow soap removal to ensure a complete rinse. The infrared sensor turns the rinse water off when hands are removed.

Although GSFSs represent an inexpensive tool that could influence HH behaviour, subjective and objective outcomes associated with its use remain unreported. Here, we report a pilot study designed to gather initial healthcare worker (HCW) perceptions about GSFSs and assess the effectiveness of this new tool at cleansing participants' hands of *Escherichia coli*.

## Methods

### HCW survey methods – HealthPartners Institute Clinical Simulation Center

HCW perceptions of GSFSs were measured via self-reported online survey made available to users via QR code after exposure to the faucet. An Abluo GSFS (Abluo Inc within Minnetonka Labs, Mound, MN, USA) was installed at the HealthPartners Institute Clinical Simulation Center (St Paul, MN, USA) and was made available to all HCWs and learners using the centre between August 2022 and March 2023. Anyone passing by the faucet in the simulation centre had the option to wash their hands and complete the QR-code survey. The first webpage of the survey informed participants of the purpose of the study and use of data. Descriptive statistics are reported. A detailed procedure of implementation and data collection can be found in [Supplementary material A1](#). This was determined not to be human subjects research by the HealthPartners Institutional Review Board.

### Bacterial removal during a GSFS handwash event

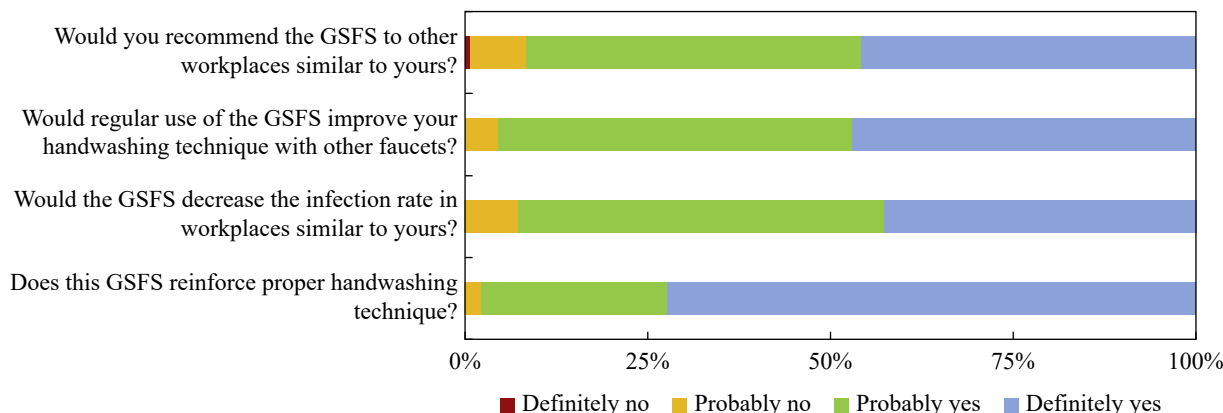
The experimental design to determine bacterial log<sub>10</sub> reduction for a handwashing event was based on literature and ASTM method E1174-21 [3–5]. Approval for assessing bacterial removal was obtained prior to beginning this study from Bethel University's Institutional Review Board (St Paul, MN, USA). A detailed procedure can be found in [Supplementary material A1](#). Briefly, *Escherichia coli* strain (ATCC 11229) was selected as the challenge organism for this study to align with ASTM method

E1174-1. Thirty non-medical participants were recruited. Informed consent was obtained before beginning, and only participants with no skin disorders who were in good health were included. Participants visited our facility on two separate days and washed their hands at a standard faucet and a GSFS each visit; thus, we measured four washes from each participant. The glove juice method was used to extract the challenge stain from one hand before washing and the other hand after washing [3]. After plating and incubation, bacterial colonies were counted. The log<sub>10</sub> bacterial reduction was determined by subtracting the log<sub>10</sub> of bacterial counts before and after each wash. After participants' final wash, they completed an eight-question survey which asked for self-reported, non-identifiable information about handwashing habits ([Supplementary material A1](#)). Data were analysed using standard statistical methods as outlined in [Supplementary material A1](#). Briefly, a one-way repeated measures analysis of variance (ANOVA) was used to determine the statistical significance of the difference between log<sub>10</sub> reductions. We also fitted a linear mixed model (LMM) to assess whether handwashing condition predicted bacteria level reduction, while also examining effects of sex, first/second visit day, self-reported moisturizer use, and self-reported skin texture (formula: bacteria level, i.e., condition + timepoint + sex + moisturizer + texture).

## Results

### Results of HCW survey

Over the seven-month period, 137 HCW surveys were collected from GSFS users. The faucet was received favourably, and [Figure 2](#) displays the question text and aggregate responses. Ninety-one per cent reported that they would 'probably' or 'definitely' recommend a GSFS to other workplaces similar to theirs. Ninety-three per cent reported that they would 'probably' or 'definitely' expect the GSFS to reduce infection rates in workplaces similar to theirs. Additionally, 95 of HCWs reported that regular use of a GSFS would 'probably' or 'definitely' improve their handwashing technique at standard faucets. The statistical comparison of subpopulations within the aggregate data have limited value because our volunteer-based sample was not selected to be representative of specific subpopulations. However, we report that there were no



**Figure 2.** Healthcare workers' responses to survey questions post-glow soap faucet system (GSFS) use.

statistically significant differences in responses with respect to age or years of service, but there were several statistically significant differences related to discipline area. Raw survey responses, statistical analysis comparing subpopulations, and the self-reported characteristics of the cohort are included in [Supplementary material A2](#).

### Results of bacterial removal study

Twenty-six participants completed the bacterial removal portion of this study. Identifying information was not collected, but we observed that most of our participants were college students. The average log<sub>10</sub> reduction for a GSFS handwash was 2.1 ( $N = 45$ ); that of a standard handwash was 1.6 ( $N = 47$ ). One-way repeated measures ANOVA analysis revealed a statistically significant difference in the average log<sub>10</sub> reduction between a standard handwash and a GSFS handwash ( $F(3,88) = (5.573)$ ,  $P=0.0015$ ). Linear mixed model analysis found a main effect of handwashing condition, with greater reduction in bacteria levels more likely to occur in the GSFS 'treatment' condition than in the 'normal' condition  $\beta = 0.45$ , standard error = 0.11,  $t(92) = 4.21$ ,  $P < 0.001$ ). No other self-reported factor (sex, moisturizer use, skin texture, or visit day) influenced bacteria reduction ([Supplementary material A1](#)). Raw bacterial count data are provided in [Supplemental material A3](#).

### Discussion

This pilot study gathered HCW impressions of GSFS and assessed the effectiveness of a GSFS at removing bacteria during a handwash event. HCW feedback was very positive ([Figure 2](#)). A significant majority of HCWs would recommend the faucet and believed it would reduce infection rates in their workplaces. Behavioural patterns surrounding HH are complex, but recognizing the benefits of an action is key to motivating high HH compliance [6]. Intriguingly, HCWs reported that regular use of a GSFS would improve their handwashing technique at standard faucets. These preliminary data suggest that a small number of GSFSs, installed at key points in a larger facility, could have a broader protective effect and be a cost-effective way to raise compliance. Infrequent but consistent use of GSFS may influence subconscious HH behaviour and thus integrate well into current nudge theory of HH [7,8]. While these data demonstrate a favourable reception, they came from a volunteer sample from a single educational environment that opted in to use of the GSFS

and survey completion. The attitude of HCWs during long-term use in a medical setting remains unknown.

In the second portion of the study, the GSFS significantly reduced the number of bacteria remaining on hands compared with a standard faucet (average bacterial log<sub>10</sub> reduction of 2.1 vs 1.6;  $P=0.0015$ ). This corresponds to  $3.1\times$  fewer bacteria remaining on hands after a GSFS wash compared with a standard wash. These bacterial log<sub>10</sub> reduction data are in line with other handwashing studies, particularly those using ATCC 11229 as a challenge organism and the glove juice method [9,10,5]. The demographics of this study were primarily college students recently exposed to a GSFS who opted in to the study; the actual efficacy in the field remains unknown.

We did not investigate why a GSFS was more effective at removing bacteria, but there are many potential reasons such as lather duration, visibility of glow soap, and soap volume. We speculate that the longer lather duration, preset by the GSFS, had the largest benefit for removing bacteria during a single wash. However, we also speculate that the visibility of glow soap would be most critical for positively influencing a culture of HH over time.

In summary, GSFSs are a new tool in the field of HH, and these preliminary data indicate that GSFSs effectively remove bacteria and are well received by the medical community. Field studies are merited to assess whether GSFSs can ultimately reduce HAIs.

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### Author contributions

**L. Kubas:** Formal analysis, Investigation, Methodology, Writing – original draft. **A. Swenson:** Investigation, Methodology, Writing – original draft. **S. Penn:** Formal analysis, Writing – original draft. **K. Christenson:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **J. Tjepkes:** Conceptualization, Methodology, Project administration. **J.Y. Ziegenfuss:** Data curation, Formal

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#### Conflict of interest

The authors declare the following conflicts of interest with respect to the research, authorship, and/or publication of this article: J.T. is listed as an inventor on the Abluo Inc. patent and is a shareholder in Abluo, Inc. K.C. and J.C. serve on the advisory board of Abluo, Inc. and hold stock warrants in the company. All other authors have no conflicts of interest to report.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jhin.2025.07.016>.

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