

Efficacy of Alcohol-based Hand Sanitizers (ABHS): A 65.9% Ethanol Hand

Wipe Exceeds the Killing Capacity of a 62% Ethanol Gel Rub

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Abstract

Decontamination of hands is accomplished by hand washing with soap or by use of waterless hand sanitizers. In 2002, the CDC stated that alcohol based hand wipes were not an effective substitute for alcohol-based hand rubs or washing hands with an antimicrobial soap and water. This recommendation was based upon the use of alcohol-impregnated wipes with 30% vol/vol., which is 50% less than the alcohol content currently used in ABHS wipes. The objective of this study was to determine whether an alcohol gel hand wipe with 65.9% ethanol is as effective as a 62% ethanol hand rub or antimicrobial soap in removing bacteria from hands.

In accordance with the method cited in the Federal Register Vol. 59 No. 116 Section 333.470, the hands of seven subjects were inoculated with a suspension of *Serratia marcescens*. Subjects washed with each of three different products with an interval of time separating each product usage. The products included the Sani-Hands® ALC 65.9% ethanol gel hand wipe (PDI, Inc.), Purell® 62% ethanol gel rub (GOJO), and Kindest Kare® antimicrobial soap containing 0.75% Triclosan (Steris, Corp.). The products were used according to manufacturer's instructions and a standard hand-washing technique was employed for use of antimicrobial soap and water.⁴⁻⁵ Recovery of viable bacteria after product usage/washing was performed using the Glove Juice recovery method. The recovery liquid was plated on TSA and enumerated after test cycles 1, 3, 7 and 10.

56 observations were analyzed. Significantly greater log reduction of *S. marcescens* was observed for the alcohol hand wipe compared to the alcohol gel ($p < 0.001$). The mean log reductions [Std. dev.] for the wipe ABHS, gel ABHS and soap were 3.44 [0.847], 2.32 [1.065], and 4.44 [1.018] respectively. The mean log reductions decreased over time for the gel rub, but not for the wipe. Only the gel rub ABHS showed decrease efficacy (log reduction from baseline) between cycles 7 and 10 (log 2.42 vs. 1.90). As expected, hand-washing with antimicrobial soap was more effective than either ABHS.

The alcohol-based hand wipe containing 65.9% ethanol was significantly more effective than the 62% ethanol gel rub in reducing the number of viable bacteria on the hands. Use of ABHS wipes by patients and healthcare providers effectively reduces hand carriage of potential pathogens. Similar studies are underway to determine the efficacy for removal of spore-forming bacteria.

Background

Alcohol-based waterless hand sanitizers for hand decontamination are an alternative to soap and water hand washing. Confusion exists regarding the parity of alcohol based hand sanitizers, specifically the efficacy of wipes versus gels. The Centers for Disease Control and Prevention (CDC) asserted in 2002 that alcohol-based hand wipes were not as effective as alcohol-based hand rubs.¹ Their recommendation was founded on previous research that used 30% vol/vol alcohol-impregnated wipes; a 50% lower alcohol concentration currently contained in alcohol-based hand wipes. The purpose of this study was to determine whether an alcohol gel hand wipe containing a higher concentration of ethanol (65.9%) was more effective or as effective as a 62% ethanol hand rub.

Objective

To determine whether the 65.9% ethanol gel hand wipe is equal to or more effective than an alcohol-based hand rub (62%) in eliminating bacteria from hands.

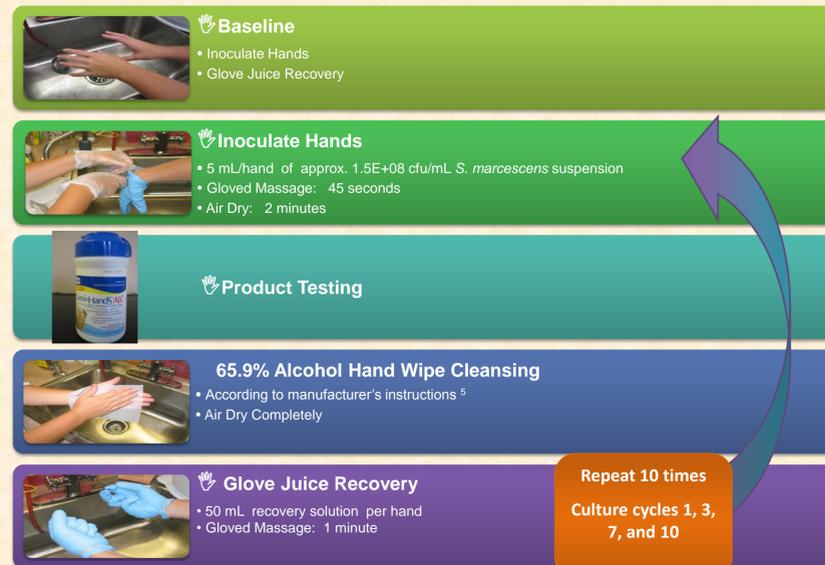
Materials and Methods

In accordance with the method cited in the Federal Register Vol. 59 No. 116 Section 333.470, the hands of seven subjects were inoculated with a 0.5 McFarland suspension (approximately 1.5×10^8 cfu/mL) of *Serratia marcescens*, ATCC No. 14756.³ Subjects washed with each of three different products with an interval of time separating each product usage.

The products included the Sani-Hands® ALC 65.9% ethanol gel hand wipe (PDI, Inc.), Purell® 62% ethanol gel rub (GOJO), and Kindest Kare® antimicrobial soap containing 0.75% Triclosan (Steris, Corp.). The products were used according to manufacturer's instructions and a standard hand-washing technique was employed for use of antimicrobial soap and water.⁴⁻⁵ Recovery of viable bacteria after product usage/washing was performed using the Glove Juice recovery method. The recovery liquid from test cycles 1, 3, 7, and 10 were each plated on trypticase soy agar (Remel) and enumerated.

Data was collected and analyzed for 56 hand washings. Statistical analysis included a two-sample t test with equal variances and mean bacterial log reduction from the baseline over the cycles for each product.

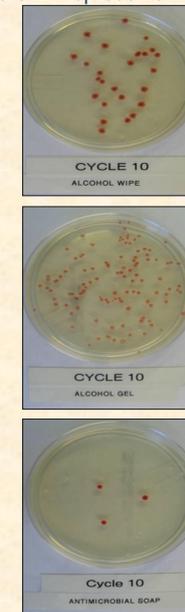
Figure 1: Hand-washing method utilized for product testing. The product test process for the 65.9% alcohol gel wipe is shown below. Testing with the 62% alcohol hand rub and the antimicrobial soap and water also followed the same method, where these products were used in place of the hand wipe.



Results

The rank order of product efficacy was: antibacterial soap > 65.9% alcohol hand wipe > 62% alcohol hand rub. Comparing the alcohol based products, the 65.9% ethanol gel hand wipe showed a significantly greater log reduction of *Serratia marcescens* than the 62% ethanol gel rub ($p < 0.001$).

Figure 2: Representative cultures from each product evaluation at Cycle 10



65.9% ethanol gel hand wipe: The overall mean bacterial log reduction was 3.44 (SD 0.847). The mean log reduction was consistent across the recovery cycles.

62% ethanol gel hand rub: The overall mean bacterial log reduction was 2.32 (SD 1.065). The mean log reduction decreased over time across the recovery cycles- a decrease in mean log reduction was observed between Cycle 7 (2.42 log) and Cycle 10 (1.90 log); see Figure 3.

Antimicrobial soap and water: The overall mean bacterial log reduction was 4.44 (SD 1.018). Standard hand washing with antimicrobial soap and water showed a greater mean bacterial log reduction than either of the alcohol products; see Figure 3.

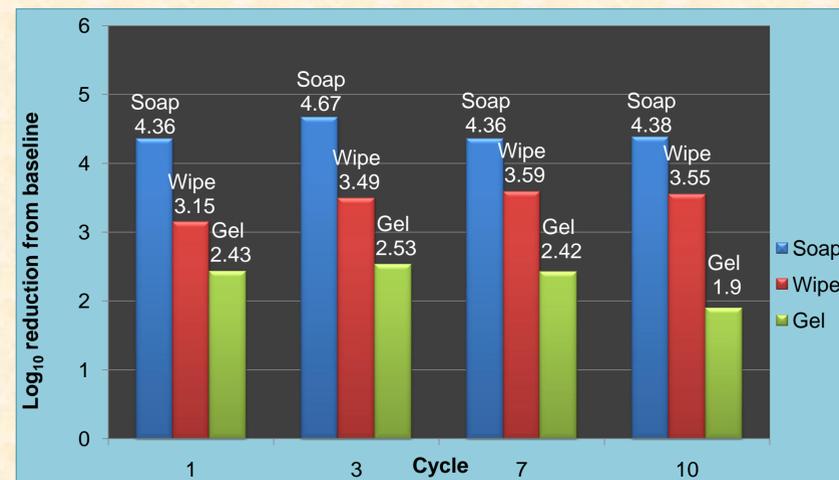


Figure 3: Mean log reduction of viable bacteria from baseline at each test cycle.

Conclusions

The 65.9% ethanol gel hand wipe was significantly more effective in reducing the amount of viable bacteria on the hands than the 62% ethanol gel rub. The greater effectiveness of the wipe product may have been due to higher ethanol content and physical removal of bacteria from the hands. Standard hand-washing with antimicrobial soap and water demonstrated the greatest bacterial reduction and was more effective than either alcohol products.

Discussion and Implications

This study sought to resolve the confusion regarding the parity of alcohol based hand sanitizers, specifically the efficacy of wipes versus gels. Previous data using 30% vol/vol alcohol-impregnated wipes showed hand gels to be more effective in removal of bacteria from hands.¹ Our data shows that if a 65.9% vol/vol alcohol-impregnated wipe is used, the wipe was more effective than the 62% alcohol gel in the removal of bacteria from hands.

Although effective, waterless hand sanitizer products should be used in conjunction with regular soap and water hand washing to ensure optimal reduction of bacterial transmission.

References

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