Investigation of Antibiotic and Antibacterial Resistance in *Staphylococcus* from the Skin of Users and Non-Users of Antibacterial Wash Products in Home Environments*

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**ABSTRACT**

Antibiotic and antibacterial resistance has been linked to the widespread overuse and misuse of antibacterial soaps. The objective of this study was to investigate the extent of, and relationship between, antibiotic and antibacterial resistance in *Staphylococcus* isolates from the skin of human participants using wash products containing triclocarban (TCC) or triclosan (TCS), as compared to those using non-wash products.

**METHODS**

**Participant Bacterial Skin Sampling**

A total of 317 unique bacterial skin samples were obtained from 196 participants. Each participant was identified by a unique study number. The bacterial skin samples were obtained from the volar aspect of the forearm, along the width of the forearm. An individual sample was comprised of the combined sampled areas from both forearms. The bacterial skin sampling was performed using a sterile 4 x 16 cm (64 cm2) template and a Stuart's swab, and was performed before product usage in all participants. The samples were extracted and stored at -70°C until analyzed.

**Sample Processing**

Each bacterial skin sample was inoculated into 2.2 mL of tryptic soy broth (TSB) (Difco Laboratories) in triplicate. After incubation at 37°C, 5% CO2 for 48 hours, serially diluted samples were inoculated into tryptic soy agar (TSA) (Difco Laboratories) and incubated at 37°C, 5% CO2 for 24-48 hours. Antimicrobial MIC determination was performed by a standardized micro-broth dilution method. Initial concentrations of the active ingredients were formulated such that a typical use-dilution concentration was achieved near the middle of the dilution scheme – TCS at 0.0234 ppm, TCC at 0.750 ppm. Negative controls were run simultaneously with all test isolates.

**Antimicrobial Susceptibility/Resistance Testing**

The antimicrobial susceptibility testing was performed using the MicroScan automated procedure (Dade MicroScan, Inc., West Sacramento, CA). The MIC for multiple antimicrobial agents was determined for *Staphylococcus aureus* (SA) and *Corynebacterium species* (CNS) isolates. Initial concentrations of the active ingredients were formulated such that a typical use-dilution concentration was achieved near the middle of the dilution scheme. The following antimicrobial agents were evaluated: oxacillin (OX), erythromycin (ERY), tetracycline (TET), trimethoprim/sulfamethoxasole (TMP/SMX), ampicillin (AMP), ciprofloxacin (CIP), clindamycin (CLD), gentamicin (GEN), imipenem (IMP), and vancomycin (VAN). Bacterial isolates from all participant groups were tested for resistance to each of the above antibiotics.

**RESULTS**

**Antimicrobial Susceptibility/Resistance Testing**

Antimicrobial susceptibility/resistance was evaluated for the bacterial isolates from each participant in each study group using a sterile 4 x 16 cm (64 cm2) template and a Stuart's swab. Each participant was identified by a unique study number. The bacterial skin samples were obtained from the volar aspect of the forearm, along the width of the forearm. An individual sample was comprised of the combined sampled areas from both forearms.

**DATA ANALYSIS**

Comparative analysis of susceptibility/resistance test results for the bacterial isolates from each participant in each study group was performed using the chi-square test to determine statistical significance. The non-user group showed an MRSA rate of 25% (1/4), while the TCC group showed an MRSA rate of 20.6% (62/301) across all isolates, as previously shown. The non-user group showed an MRSA rate of 25% (1/4), while the TCC group showed an MRSA rate of 20.6% (62/301) across all isolates, as previously shown.

**CONCLUSION**

There is a relationship between the use of antibacterial wash products and the development of both antibiotic and antibacterial resistance. The findings of this study indicate that the use of antibacterial wash products containing triclocarban (TCC) or triclosan (TCS) may contribute to the selection and propagation of drug-resistant bacteria on human skin. The data were evaluated for cross-resistance – i.e. whether highly antibiotic-resistant isolates also contribute to the selection and propagation of drug-resistant bacteria on human skin.

**REFERENCES**


**ACKNOWLEDGEMENT**

Support for this study, especially the special thank you to the participants. Bethesda, MD

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