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A multi-beach study of *Staphylococcus aureus*, MRSA, and enterococci in seawater and beach sand

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ABSTRACT

Incidences of *Staphylococcus aureus* and methicillin resistant *S. aureus* (MRSA) have risen worldwide prompting a need to better understand routes of human exposure and whether standard bacterial water quality monitoring practices adequately account for this potential threat. Beach water and sand samples were analyzed during summer months for *S. aureus*, enterococci, and MRSA at three southern California beaches (Avalon, Doheny, Malibu Surf Rider). *S. aureus* frequently was detected in samples of seawater (59%, n=328) and beach sand (53%, n=358). MRSA sometimes was detected in seawater (1.6%, n=366) and sand (2.7%, n=366) at relatively low concentrations. Site specific differences were observed, with Avalon Beach presenting the highest concentrations of *S. aureus* and Malibu Surf Rider the lowest in both seawater and sand. *S. aureus* concentrations in seawater and sand were correlated to each other and to a variety of other parameters. Multiple linear regression on the combined beach data indicated that significant explanatory variables for *S. aureus* in seawater were *S. aureus* in sand, water temperature, enterococci in seawater, and the number of swimmers. In sand, *S. aureus* concentrations were related to *S. aureus* in seawater, water temperature, enterococci in seawater, and inversely to surf height classification. Only the correlation to water temperature held for individually analyzed beaches and for *S. aureus* concentrations in both seawater and sand. To provide context for these results, the prevalence of *S. aureus* in sand was compared to published fomite studies, and results suggested that beach prevalence was similar to that in homes.

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