

Survival of clinical and environmental strains of methicillin-resistant *Staphylococcus aureus* (MRSA) in marine waters

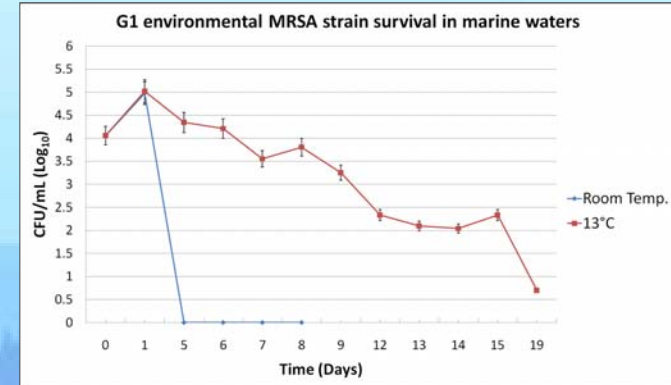
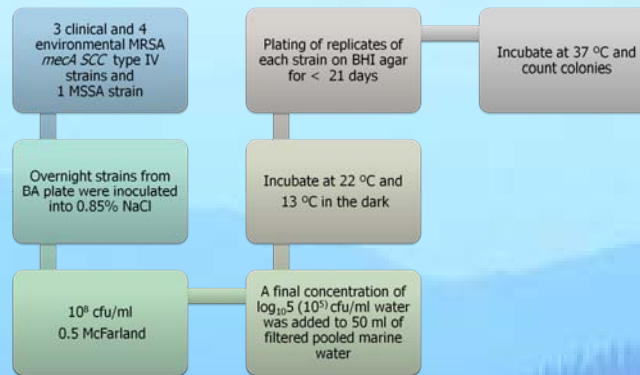
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Abstract

The aim of this study was to examine and compare the survival dynamics of environmental and clinical strains of methicillin-resistant *Staphylococcus aureus* [MRSA] in marine waters at two different temperatures, 13 °C and 22 °C. Four environmental strains isolated from local marine waters, three clinical strains, and one methicillin-susceptible *Staphylococcus aureus* (MSSA) strain were examined. Strains were inoculated in 0.85% NaCl from blood agar plates to make a 0.5McFarland standard. A final concentration of $10^{10.5}$ (10^5) colony forming units (cfu/ml water) was seeded into 50 ml of filtered pooled marine water. Samples were incubated at 13°C and at 22°C in the dark and colony counts were determined for ≤ 21 days. At 13°C a ≤ 1 -2 log reduction of cfu occurred at day 5-6, while at 22°C a 4-5 log reduction occurred between day 5-7 for all strains tested. Survival at 13 °C varied by strain with some strains having ≤ 1 log reduction by day 6 while others between 1-2 log reduction. Based on the limited number of strains tested the study suggests that under normal environmental conditions of local NW marine beaches (~13°C), MRSA survives better than at 22°C. What risk if any contaminated marine waters has for the beachgoers is unknown and requires more research.



(C)

Figure 3. Survival of clinical SCC_{mec} type IV MRSA (A) and environmental SCC_{mec} type IV isolates (B and C) at different temperatures. Numbers represent the average of two replicas. Standard deviations are represented by error bars with percentage.

- Under normal environmental conditions of local NW marine beaches (~13 °C), MRSA survives better than at 22 °C.

Introduction

- Methicillin-resistant *Staphylococcus aureus* (MRSA) is a life-threatening multidrug-resistant bacterium that can cause severe skin infections as well as other diseases.
- There are two classifications for MRSA infections: hospital-acquired MRSA (HA-MRSA) and community-acquired MRSA (CA-MRSA).
- In 2008 and 2010 our laboratory detected MRSA in the water at public marine beaches in the Seattle metro area.
- By comparing the survival of different strains of MRSA at different temperatures in marine waters will help assess the risk to public health.

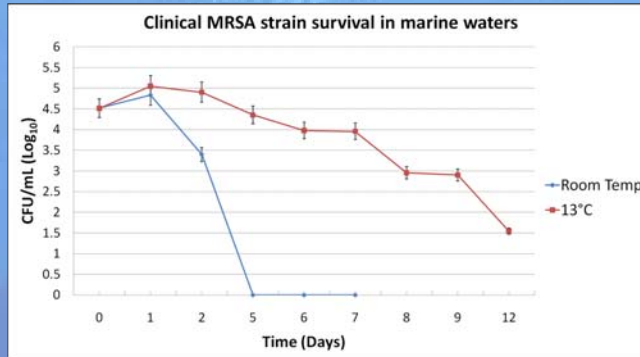


Figure 1. Colored SEM of MRSA (gram +) cdc.gov

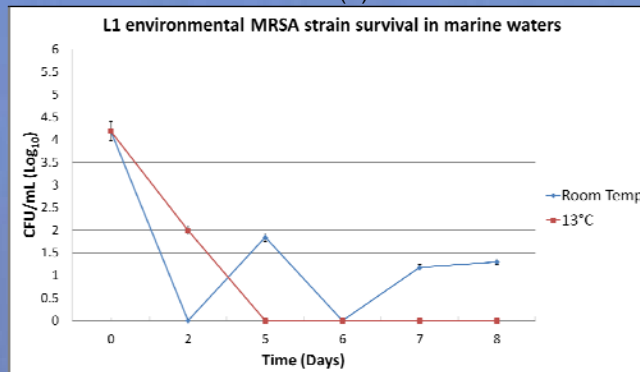


Figure 2. MRSA wound infection cdc.gov

Results



(A)



(B)

Conclusions

- Our results indicate that the temperature influences the survival over time of the different MRSA strains in marine water with no additional organic materials and survival varies between strains.
- Clinical strains survive for 5-7 days at 22 °C which is different then that reported by Tolba et al, [Int J Hyg Environ Health, 211:398, 2008] which found only a 2 log drop when 14 isolates were averaged.
- What risk if any contaminated marine waters has for the beachgoers is unknown and requires more research.

Future work

- Repeat the (surv)al experiment in marine waters adding more diversity of strains and organic materials to the media.
- Compare the survival dynamics in fresh waters also.



Acknowledgments

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Materials & Methods

Table 1. List of *Staphylococcus aureus* strains used

Strains	Category	Source	mecA	SCCtype
ATCC	MSSA	clinical	-	N/A
MS361	MRSA	clinical	+	II
MS1053	MRSA	clinical	+	I
Va # 6	MRSA	clinical	+	IV
9-48	MRSA	marine water	+	IV
G1	2010 environmental MRSA isolates	stream water	+	IV
L1	2010 environmental MRSA isolates	marine water	+	IV
M1	2010 environmental MRSA isolates	fresh water	+	IV