

The overall Bioburden by Total Colony Count does not predict Presence of Pathogens with high Clinical Relevance in the Environment of Hospitals and Community

Felix C. Widmer, MD¹, Reno Frei, MD¹, John Boyce, MD², Andriy Romanyuk, PhD³, Sarah Tschudin Sutter, MD, MSc¹, Andreas F. Widmer, MD MS¹

¹ University Hospital Basel, Basel, Switzerland, ² Yale University, New Haven, CT, USA, ³ Glas Trösch AG, Bützberg, Switzerland

INTRODUCTION

Health-care associated infections (HAIs) affect millions of patients and increase morbidity and mortality. Most pathogens from HAIs originate from patient flora, but recent data show that the environment also plays an important role in transmission of pathogens. The study compared the overall bioburden (total colony count) and the frequency of pathogens of high clinical relevance (PHCR) obtained from high-touch surfaces from hospitals and from the community.

OBJECTIVES

- Estimate correlation between overall bioburden and PHCR
- Show difference in overall bioburden and PHCR in hospitals and community

METHODS

The overall bioburden was assessed by total colony count (TCC) on tryptic soy agar contact plates. In addition, two selective agars: for *S. aureus* (Baird Parker, Heipha AG, Eppelheim, Germany) and for gram-negative pathogens (MacConkey) were used to improve sensitivity for pathogens of high clinical relevance (PHCR), e.g. *Staphylococcus aureus*, Enterobacteriaceae, *Acinetobacter baumannii*. Positive cultures were routinely analyzed by matrix-assisted laser desorption/ionization – time of flight mass spectrometry (MALDI-TOF).

PHCR were defined by the “Top organisms” list of the CDC’s National Healthcare Safety Network (NHSN). To improve the definition of “Top organisms”, we further excluded commensals from the skin from the CDC “TOP” organisms.

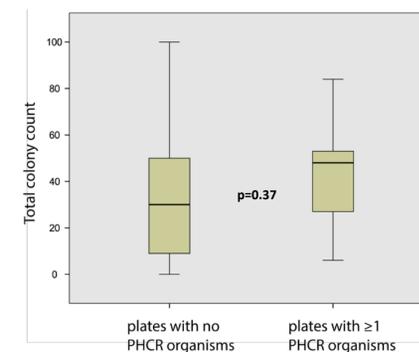
<https://www.cdc.gov/nhsn/xls/master-organism-com-commensals-lists.xlsx>

RESULTS

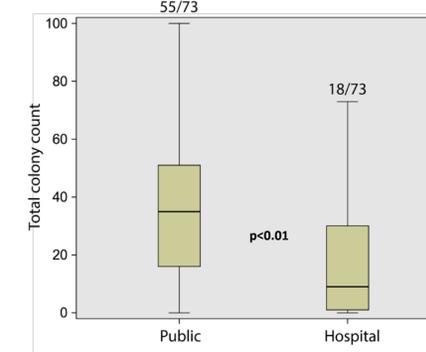
1'431 contact plates were processed from 477 sampling areas: 153 from hospitals and 324 from publicly accessible institutions or devices. In 73/477 (15%) sampling areas ≥ 1 PHCR grew from cultures.

The overall bioburden (total colony count, TCC) did not correlate with presence of PHCR ($p=0.37$).

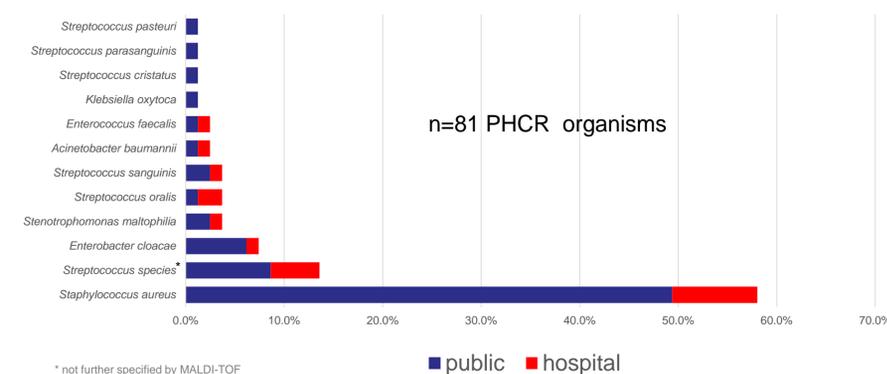
Comparison Overall Bioburden and Presence of Pathogens of High Clinical Relevance (PHCR)



Comparison Overall Bioburden from Public and Hospital Samples



Comparison of positive PHCR Pathogens (%) from Public and Hospital Locations



* not further specified by MALDI-TOF

DISCUSSION

Almost all previous studies assessing the bioburden in the environment focused on total colony counts (CFU)/cm² and/or specific pathogens of interest such as methicillin-resistant *S. aureus* (MRSA), vancomycin-resistant enterococci (VRE) and more recently gram-negative enterobacteriaceae expressing extended spectrum betalactamases (ESBL) or carbapenemases. The common use of MALDI-TOF allowed us to analyze all positive cultures to the species level, previously almost impossible due to financial and workload restrictions using biochemistry methods for identification. This study clearly demonstrates that studies evaluating overall bioburden are clinically not useful, lacking a correlation between overall bioburden and detection of PHCR pathogens.

A limitation of the study is the definition of PHCR. To our knowledge, only the CDC published a list of PHCR, called “TOP” pathogens, that surprisingly also included skin commensals. We therefore adapted the “TOP” list and excluded skin commensals. In addition, we did re-analyze the data by using a different definition of PHCR, defined by any growth of pathogen NOT listed as skin commensal. Similarly, there was no significant correlation between overall colony counts and presence of PHCR (data not shown).

CONCLUSIONS

- Overall bioburden measured by Total Colony Counts does not predict presence of clinically important pathogens
- Bioburden was higher on surfaces in public locations than in hospitals

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