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Are toilet seats a vector for transmission of methicillin-resistant *Staphylococcus aureus*?

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Abstract

We studied the bacterial burden on toilet seats in a children's cancer hospital to validate a policy requesting that immunocompromised children use alcohol wipes on the seats prior to use of the toilets. Methicillin resistant *Staphylococcus aureus* (MRSA) was recovered from 3.3% of hospital toilets when wipes were not in use. Use of wipes resulted in a 50-fold reduction in mean daily bacterial counts and eliminated MRSA.

Keywords

MRSA; *Staphylococcus aureus*; toilet; infection control; immunocompromised

Antibiotic resistant bacteria are an increasing problem for infection control. Since the emergence of community-acquired forms of methicillin-resistant *Staphylococcus aureus* the problem has become even more acute. These strains are associated with higher virulence than traditional hospital-acquired MRSA, and are not only entering the healthcare system from the community but are becoming established in hospitals.¹ Similarly, vancomycin-resistant enterococci (VRE) have become increasingly prevalent in hospitals and represent a severe threat to immunocompromised or critically ill patients as few antibiotic choices are available for treatment of these pathogens.² Potential modes of acquisition of these gram-positive bacteria are of keen interest to infection control programs because this knowledge might lead to effective means of preventing transmission or acquisition.

St. Jude Children's Research Hospital is a children's cancer hospital and research institute dedicated to prevention and treatment of catastrophic illnesses of childhood. Because all of our patients are immunocompromised, infection control is of prime importance. The St. Jude Infection Control Program conducts daily whole house surveillance to monitor for hospital-acquired infections. In addition, culture-based surveillance of inpatient populations that varies in intensity by risk factors is conducted, focusing on epidemiologically important pathogens including MRSA and VRE. Increases in the prevalence of MRSA and VRE in 2006–2007 led us to review our Policies and Procedures. One area of potential concern identified was shared use of objects that could potentially provide a source of fomite transmission. It was recognized

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that outpatients were sharing toilet facilities with other patients, and potentially staff and visitors, in some parts of the hospital. This raised the possibility that fomite transmission could occur by contact with toilet seats. A policy was put into place providing alcohol wipes (PDI Super Sani Wipes, Professional Disposables International, Inc., Orangeburg, NY, 55% isopropyl alcohol) in bathrooms designated for patient use in the outpatient clinics. Patients and parents were instructed through signage to clean the toilet seat before use. However, no data were available as to the actual risk or the effectiveness of this intervention. This prompted conduct of the present study.

Six toilets were selected for daily cultures. These included male and female employee-only toilets in a research area of the institution, male and female public toilets in the lobby of the hospital, an accessible, unisex toilet in the outpatient area that was not equipped with alcohol wipes, and a patient-only toilet in the outpatient area that was equipped with alcohol wipes. Toilets were swabbed twice using a plastic guide to define a 2×2 inch square on the midpoint of the left wing of the toilet seat. The two cultures were taken using a standard moistened bacterial culturette immediately before and 1 minute after cleaning the toilet seat with the alcohol wipes. Total bacterial counts were determined by 48 hour culture on blood agar plates (tryptic soy agar supplemented with 3% v/v sheep erythrocytes) at 37°C. MRSA and VRE were identified using standard methods and defined media (CHROMagar for MRSA, Becton Dickinson and Co., Sparks, MD, and Bile Esculin with Vancomycin Agar for VRE, Edge Biologicals, Memphis, TN). Cultures were taken daily at 4 PM on weekdays for 4 weeks. The plastic guide was cleaned between each use with alcohol, and a terminal swab of the guide itself was taken to provide a baseline contamination rate.

The mean daily bacterial burden was significantly lower ($p < 0.01$ by paired Student's t-test) on the toilet where wipes were available compared to the patient toilet where wipes were not available (Table). No significant differences in bacterial burden were found on other toilets when stratified by location in the hospital or by gender. MRSA was recovered at low colony counts (1–3 colony forming unit (CFU) per square inch) on 3.3% of the toilets where wipes were not available compared to none on the toilet with wipes. VRE was not found on any toilet. Experimental use of alcohol wipes resulted in a 99.75% kill of all bacteria on employee and public toilet seats (6.6 CFU/sq in vs. 0.02 CFU/sq in; $p < 0.001$ by paired Student's t-test). No MRSA was recovered from toilet seats after use of wipes.

The mean bacterial burden reported here on toilet seats is similar to that reported from hospitals and clinics in the only similar study we could find through PubMed searches. In that 1979 study, colony counts on hospital toilets ranged from 5 to >100 CFU per square inch, and organisms associated with skin such as staphylococci were more frequently isolated than were stool organisms such as enterobacteriaceae.³ Although we did not speciate organisms other than VRE and MRSA, this rough distribution parallels our findings (data not shown). MRSA has been cultured from toilet seats in the inpatient isolation rooms of patients with diarrhea and MRSA colonization⁴, as have *Clostridium difficile* and VRE.⁵ To our knowledge, however, this is the first report documenting MRSA on public toilets in outpatient areas of a hospital. This is particularly worrisome for hospitals such as ours which deal with immunocompromised patients and at which the majority of care is delivered on an outpatient basis. Policies to emphasize hand hygiene and strictly cohort isolation patients in outpatient areas of the hospital including bathrooms should be considered, as should methods to decontaminate toilets between uses as has been attempted in our hospital.

In summary, MRSA can be cultured from toilet seats in a children's hospital despite rigorous daily cleaning. This represents a potential risk to patients who may acquire it by fomite transmission from colonized persons, and represents a potential reservoir for community acquisition. Use of alcohol wipes kills bacteria present on the seats prior to use, and generally

decreases the mean daily bacterial load on toilets where wipes are made available. Although this study does not positively implicate toilet seats in the transmission of MRSA, something which should be studied further, it provides support for our policy of providing alcohol wipes in patient bathrooms. We are now examining alternative methods, such as liquids or foams that can be dispensed onto toilet paper for cleaning before use.

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Table

Bacterial counts on toilet seats in a children's hospital.

		Mean $\pm$ SEM CFU/sq in.
Location		
	Employees – Research Area	5.3 $\pm$ 1.5
	Employees – Hospital	7.7 $\pm$ 3.1
	Patients – No Wipes	4.5 $\pm$ 2.6
	Patients – Wipes Available	0.1 $\pm$ 0.1
Gender		
	Male	5.1 $\pm$ 2.4
	Female	8.0 $\pm$ 2.4
Effect of Wipes		
	Before	6.7 $\pm$ 2.2
	After	0.04 $\pm$ 0.0

CFU/sq in. = colony forming units per square inch