Microbial Burden (MB) of Objects (obs) in ICU Rooms (rms)

CD Salgado[1], KA Sepkowitz[2], T Plaskett[2], JF John[3], JR Cantey[1], HH Attaway[1], LL Steed[1], HT Michels[4], MG Schmidt[1]

[1]Med. Univ. of South Carolina, Charleston, SC, [2]Mem. Sloan Kettering Cancer Ctr., New York, NY, [3]Ralph H Johnson VA, Charleston, SC, [4]Copper Dev. Association, New York, NY.

135 Rutledge Avenue
Charleston, SC 29425
Ph: 843-792-4541
Fax: 843-792-6680
salgado@musc.edu

Abstract

Background: The role of the environment for microbe transmission in hospitals has not been adequately described.
Methods: Obs (bed rails, overbed tray, chairs, call button, data device, & IV pole) in randomly selected ICU rms in 3 hospitals (A, B & C) were sampled by sterile wipes and the MB determined as colony forming units (cfu)/100cm^2. The MB of the rm was the sum of the MB of the obs in that rm.
Results: 1760 obs in 160 rms were sampled (660 obs in 60 rms in A & B; 440 obs in 40 rms in C). The mean (m) MB of the rm was 16,885 cfu/100cm2. Bed rails had the highest mMB comprising 58% of the MB in A, 49% in B, and 89% in C. Obs in close proximity to the pt had significantly higher mMBs compared to other obs in the rm; bed rails, call button, and chair at A (p 0.04 to <0.0001); bed rails, call button, chair, and data device at B (p 0.01 to 0.0001); bed rails, and chair at C (p 0.03 to 0.0002). *Staphylococcus* was the predominant organism isolated from each ob and each rm comprising 65% of the mMB in A, 73% in B, and 60% in C (figure 2). MRSA, VRE, and gram negatives were isolated but were generally <5% of the mMB.
Conclusions: Obs found in ICU rms can serve as a reservoir for spread of microbes, particularly staphylococci. Obs in close proximity to pts pose the greatest risk. Strategies are needed to reduce potential spread from these obs.

Introduction

Transmission of organisms from patient to patient requires 1) environmental contamination and 2) ineffective or incomplete compliance with infection control measures. If patients become colonized with these organisms, healthcare-acquired infections may develop. Organisms are capable of surviving on inanimate surfaces for extended periods; yet the distribution of these organisms within a patient's room is poorly characterized. Information regarding where specific resistant organisms may be concentrated in the environment and thus serve as a reservoir for patient to patient spread could lead to development of additional interventions to reduce this bioload.

Objective

We sought to determine the microbial burden (MB) on frequently touched inanimate objects in the ICU rooms of patients at three different US hospitals.

Methods

Study Centers

The Medical University of South Carolina is a 660 bed academic facility with 17 MICU beds. The hospital is a referral center for all of South Carolina and offers treatment for all medical and surgical subspecialties including solid organ and bone marrow transplantation.

Memorial Sloan Kettering Cancer Center is a 431 bed academic facility with 20 beds in a mixed medical and surgical ICU. The hospital is a national referral center for treatment of cancer and bone marrow transplantation.

The Ralph H Johnson Veteran's Administration is a 120 bed facility with 8 MICU beds. The hospital is a referral center for all veterans of the low country area of South Carolina and offers treatment for all medical and surgical subspecialties excluding transplantation.

Sampling Method

Objects (bed rails, overbed trays, chairs, call buttons, data devices, & IV poles) in randomly selected MICU rooms in 3 hospitals (A, B & C; Figure 1) were sampled weekly for 10 weeks.

A 10cm x 10cm area was vigorously wiped (side to side using 5 strokes) with a pre-moistened rayon/polyester sterile wipe. The wipe was placed in a sterile tube with 3ml of sterile PBS/LT. This was vortexed for 1 minute and allowed to settle for 5 minutes. The sample was plated onto TSA plus sheep blood agar (total microbes), mannitol salt agar (staphylococci), MacConkey agar (gram negatives), ChromAger MRSA (MRSA), and bile esculin azide plus vancomycin agar (VRE). Plates were incubated between 35° to 37°C for 24 to 48 hours.

Calculations and Statistical Analysis

The MB was determined as colony forming units (cfu) per 100cm^2. The MB of each room was calculated as the sum of the MB of the objects within that room. The mean overall MB of a room was calculated as well as that of each object sampled. The MB due to total bacteria, *Staphylococcus*, MRSA, VRE, and gram negative organisms was calcuated for each room and for each object.

The MB of each room as well as of each object was compared by the Wilcoxon Rank Sum Test (S-Plus statistical software, Seattle, WA). A P-value of ≤0.05 was considered to be statistically significant.

Figure 1. Schematic of Objects in Patient ICU Room

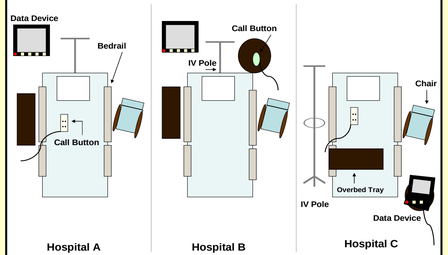


Figure 2. Mean MB of Objects in Patient ICU Rooms

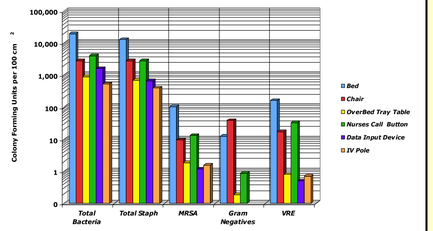
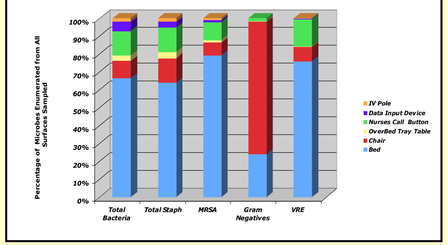


Figure 3. Distribution of MB Among Objects in Patient ICU Rooms



Results

1760 objects in 160 rooms were sampled
- 660 objects in 60 rooms in Hospitals A & B
- 440 objects in 40 rooms in Hospital C

The mean MB of the room was 16,885 cfu per 100cm^2 (Figure 2)
- Bed rails had the highest mean MB (Figure 3) comprising
  - 58% of the MB in Hospital A
  - 49% in Hospital B
  - 89% in Hospital C

Objects in close proximity to the patient had significantly higher mean MBs compared to other objects in the room
- Bed rails, call button, and chair at Hospital A (p 0.04 to <0.0001)
- Bed rails, call button, chair, and data device at Hospital B (p 0.01 to 0.0001)
- Bed rails, and chair at Hospital C (p 0.03 to 0.0002)

Staphylococcus was the predominant organism isolated from each object and each room comprising
- 65% of the mean MB in Hospital A
- 73% in Hospital B
- 60% in Hospital C

MRSA, VRE, and gram negatives were isolated but were generally <5% of the mean MB.

Conclusions

- An environmental sampling method was developed and allowed for detailed analysis of the MB of commonly touched objects in patient ICU rooms.
- Staphylococci were the predominate organism isolated within this MB.
- Objects found in ICU rooms can serve as a reservoir for the spread of bacteria, particularly staphylococci, to patients, healthcare workers, and visitors.
- Objects in close proximity to patients pose the greatest risk, particulalry bed rails.
- Patient acquisition of organisms that we recovered from ICU rooms may lead to healthcare-acquired infections resulting in substantial morbidity and mortality.
- Future studies should focus on strategies to reduce high level bacterial contamination of common objects in patient rooms and potential spread of these bacteria in order to potentially reduce healthcare-acquired infections.

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