

Abstract

Background: It is estimated that the number of healthcare associated infections (HAIs) in U.S. hospitals is approximately 1.7 million/year. Cross-transmission of microorganisms by the hands of healthcare workers is considered the main route of spread of HAIs. However, cross-contamination from a patient's own hands has been virtually unstudied, even though it is well established that touch sites within hospitals are often contaminated by pathogens and infections may be acquired through these environmental sources.

Purpose: The primary purpose of this study was to obtain data regarding the prevalence and nature of hand contamination by pathogenic microorganisms for patients in an acute care hospital.

Methods: All patients gave informed consent prior to participation. A research nurse sampled the hands of 100 medical/surgical patients who met the inclusion criteria using a standard hand sampling technique at least 48 hours after admission. A hand hygiene practices survey was given simultaneously. Hand samples were plated for total aerobic counts and onto selective media for pathogenic marker organisms, including Methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridium difficile*, *Acinetobacter*, Vancomycin-resistant *Enterococci* (VRE), and total gram-negative organisms.

Results: The mean total aerobic plate count was 5.74 ± 0.56 log CFU/hand indicating that proper hand sampling technique was used. Thirty-nine percent of patients tested positive for at least one pathogenic marker organism; 14% of the samples were positive for MRSA, 14% were positive for *C. difficile*, 11% were positive for *Acinetobacter*, 9% were positive for VRE, and 34% were positive for the presence of gram-negative organisms. Of the 25 patients with a diagnosis of infection on discharge, only one was hospital acquired involving MSSA infection of a picc line. There was no difference in reported hand washing frequency between patients with or without hand contamination. Significantly more patients with positive cultures were discharged to an institution rather than home (9% vs 2%, $p=0.05$).

Conclusion: A large proportion of patients tested positive for organisms associated with substantial morbidity and mortality 48 or more hours after admission. The data obtained in this pilot study will be used to design further studies, including a randomized trial testing various patient hand hygiene protocols.

Introduction

Healthcare associated infections (HAIs) are a leading cause of death in the U.S. It is estimated that the number of HAIs in U.S. hospitals is approximately 1.7 million/year.¹ Hand hygiene by healthcare providers is considered the single most important mechanism to prevent transmission of pathogenic organisms from patient to patient.² However, contamination from a patient's own hands has been virtually unstudied, even though it is well established that touch sites within hospitals are often contaminated by pathogens and infections may be acquired through these environmental sources.

The purpose of this study was to:

- Obtain data regarding the prevalence and nature of hand contamination by pathogenic microorganisms
- Examine self-reported hand hygiene attitudes and practices for patients in an acute care hospital.
- Investigate correlation between patient hand contamination and subsequent infection

Material and Methods

Hand Hygiene Survey: After obtaining consent and prior to hand sampling, patients were asked a series of questions to assess their hand hygiene practices, attitudes, and knowledge. Responses were assigned a score and differences in average responses were compared for patients with and without hand contamination.

Hand Sampling: A research nurse sampled the hands of 100 medical/surgical patients who met the inclusion criteria using a standard sterile hand sampling technique (glove juice method) at least 48 hours after admission.

Sample Preparation: Twenty ml of each patient sample was centrifuged at 10,000 g for 10 min. Fifteen ml of the supernatant was removed; the pellet was resuspended in the remaining 5 ml of supernatant. The concentrated sample was then plated onto selective media or diluted 100 fold in Tryptic Soy Broth (TSB) and plated onto Tryptic Soy Agar (TSA). Plates were incubated at 37°C for 30 ± 4 h.

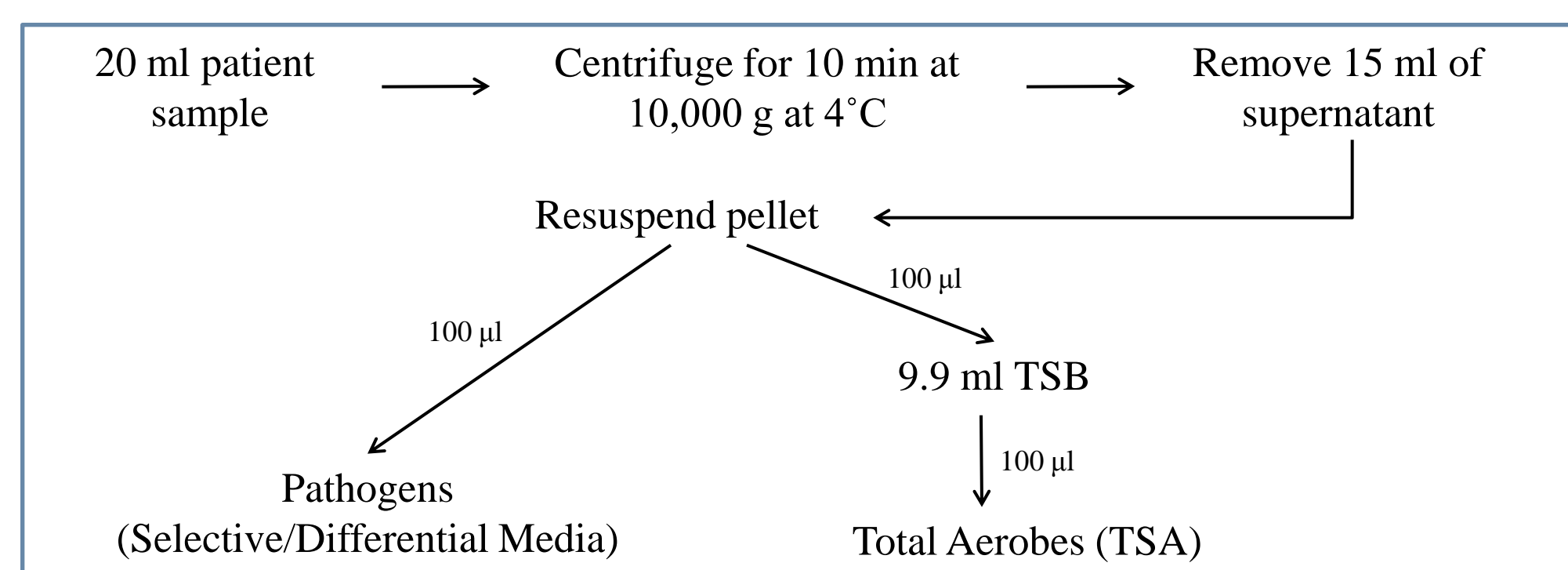


Figure 1: Sample preparation schematic used for bacteria detection.

Pathogen Detection: Hand samples were plated for total aerobic counts and onto selective media for pathogenic marker organisms, including Methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridium difficile*, *Acinetobacter*, Vancomycin-resistant *Enterococci* (VRE), and total gram-negative organisms. Plating schematic with specific media used and positive result criteria can be found in Figure 2. Contamination results can be found in Table 1 and Table 2.

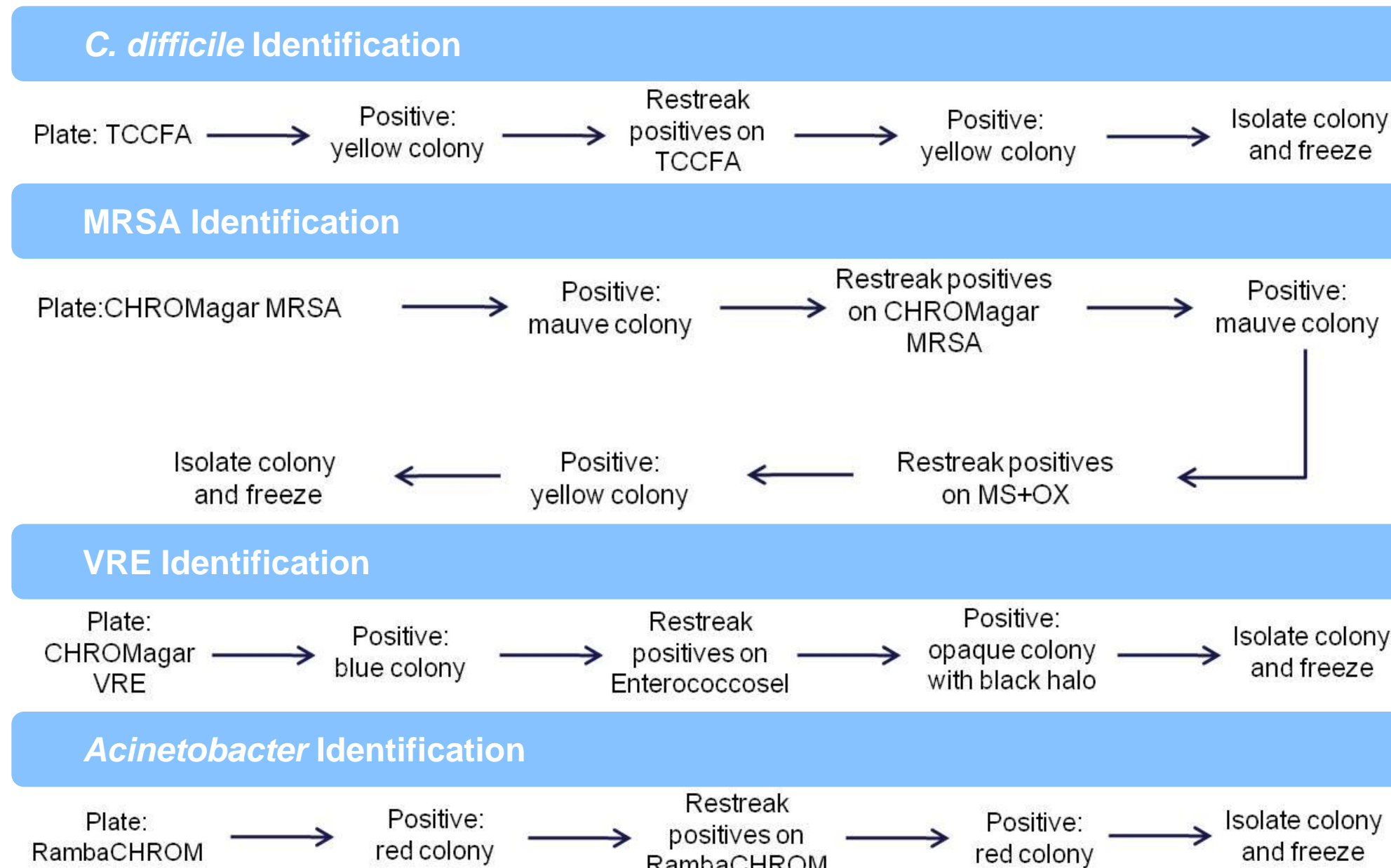


Figure 2: Plating schematic used for pathogen detection and identification.

Results: Pathogen Detection

Hand Contamination: The mean total aerobic plate count was 5.74 ± 0.56 log CFU/hand which is consistent with previous studies.³ This indicates that proper hand sampling technique was used by the research nurses. Results for the individual pathogens can be found in Table 2.

Of the 25 patients with a diagnosis of infection on discharge, only one patient had a hospital acquired infection (MSSA).

Detection	Positive Samples	Total Samples	Percentage Positive
1 pathogen	39	100	39.0%
2 pathogens	8	100	8.0%

Table 1: Frequency of patients with pathogenic bacteria on their hands.

Pathogen	Positive Samples	Total Samples	Percentage Positive
<i>C. difficile</i>	14	100	14.0%
MRSA	14	100	14.0%
VRE	9	100	9.0%
<i>Acinetobacter</i>	11	100	11.0%
Gram Negative Organisms	34	100	34.0%

Table 2: Frequency of specific pathogenic bacteria on patients' hands after at least 48 h in an acute care hospital.

Results: Hand Hygiene Survey

- Self-reported hand washing was consistently lower in the hospital compared to home.
- Results showed that patients had awareness of the importance of hand hygiene.
- There was no difference in self-reported hand washing frequency between patients with or without pathogenic hand contamination.
- Significantly more patients with positive cultures for pathogenic bacteria were discharged to an institution rather than home (9% vs. 2%, $p=0.05$) suggesting they may have been more functionally impaired and therefore may have required more assistance with hand hygiene from healthcare workers.

Select Survey Results

Question	Always	Almost Always	Often	Almost Never	Never
	5	4	3	2	1
I prefer to wash my hands with soap and water	60%	29%	9%	2%	0%
Average Score for patients Positive for Gram Negative Bacteria or Pathogens: 4.57 Average Score for patients Negative for Gram Negative Bacteria or Pathogens: 4.37					P = 0.18
I prefer to wash my hands with an alcohol based sanitizer	4%	20%	38%	26%	11%
Average Score for patients Positive for Gram Negative Bacteria or Pathogens: 2.63 Average Score for patients Negative for Gram Negative Bacteria or Pathogens: 2.98					P = 0.08
I think my handwashing practices are fine	28%	48%	10%	14%	0%
Average Score for patients Positive for Gram Negative Bacteria or Pathogens: 3.84 Average Score for patients Negative for Gram Negative Bacteria or Pathogens: 3.96					P = 0.12

Question	Always	Almost Always	Often	Almost Never	Never
Handwashing prevents the spread of infection to myself	63%	36%	1%	0%	0%
Handwashing prevents the spread of infection to my family	62%	38%	0%	0%	0%

Conclusion

- Thirty-nine percent of patients tested positive for pathogenic organisms associated with HAIs 48 or more hours after admission. Because the study focused solely on contamination rates 48 hours post admission, it is difficult to make strong conclusions on the source of contamination and or patient colonization status.
- The data obtained in this pilot study indicate that patients should be included in an institution's efforts to improve hand hygiene as patient hands are a potential vector in transmission of HAIs.
- Functionally impaired patients had a higher rate of hand contamination suggesting they may require special attention from healthcare providers to ensure effective hand hygiene.
- Future studies are needed to better understand the relationship between patient hand hygiene, the presence of pathogenic organisms on patients' hands and the occurrence of HAIs.

References

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