



Major Article

Rate of contamination of hospital privacy curtains in a burns/plastic ward: A longitudinal study



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Background: Since hospital patient privacy curtains can harbor bacteria, are high-touch surfaces, and are cleaned infrequently, they may be involved in pathogen transmission. The aim of this longitudinal prospective study was to understand curtain contamination to inform curtain hygiene protocols, thereby minimizing the role of curtains in pathogen transmission.

Methods: Over 21 days, cultures of 10 freshly laundered curtains (8 test curtains surrounding patient beds and 2 controls in an unoccupied staff room) were taken in the Regional Burns/Plastics Unit. Contact plates were used to sample the curtains near the edge hem where they are most frequently touched. Microbial contamination and the presence of methicillin-resistant *Staphylococcus aureus* (MRSA) were determined.

Results: By day 3, test curtains showed increased microbial contamination (mean colony-forming units [CFU]/cm² = 1.17) compared to control curtains (mean CFU/cm² = 0.19). Test curtains became increasingly contaminated over time, with mean CFU/cm² for days 17 and 21 of 1.86 and 5.11, respectively. By day 10, 1/8 test curtains tested positive for MRSA, and 5/8 were positive by day 14.

Conclusions: Patient privacy curtains became progressively contaminated with bacteria, including MRSA. Between days 10 and 14 after being hung, curtains showed increased MRSA positivity. This may represent an opportune time to intervene, either by cleaning or replacing the curtains.

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BACKGROUND

Healthcare-associated infections contribute to unnecessary patient suffering and to increased healthcare costs.^{1,2} While person-

to-person contact is the primary pathway, studies show that environmental surfaces can serve as important routes of transmission as well.³

Hospital privacy curtains surrounding patient beds are at a high risk for cross-contamination for several reasons: 1) they are frequently touched;⁴ 2) they are infrequently cleaned or changed; and 3) people may be less likely to disinfect their hands after contact with inanimate objects.⁵ Furthermore, a recent cross-sectional study found that curtains were contaminated with up to 13.3 colony-forming units (CFU)/cm² of bacteria, and 31% of the curtains grew methicillin-resistant *Staphylococcus aureus* (MRSA).⁶

Unfortunately, cleaning budgets and staffing have been cut across Canada.⁷ Therefore, it is important to know the rate and extent of contamination to optimize curtain cleaning/changing protocols.

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The objectives of this study were to determine the level and trajectory of contamination of curtains, including with MRSA. We hypothesized that patient privacy curtains become increasingly contaminated over time.

METHODS

In this longitudinal prospective pilot study in the Regional Burn/Plastic Unit, Health Sciences Center, in Winnipeg, Canada, surveillance cultures of curtains were taken over a 21-day period.

Ten standard, identical polyester/cotton curtains were freshly laundered by a commercial company and packed in plastic nonsterile bags. Four curtains were placed in a 4-bed room, 4 were placed in 2 double rooms, and 2 controls were placed in areas without direct patient or caregiver contact. No rooms were occupied by patients with MRSA. The curtains were located approximately 30 cm from the bed and could be moved for privacy needs. Curtains were changed prior to day 21 if they became visibly soiled.

Contact testing was done with Dey/Engley Neutralizing Agar Rodac Contact Plates (Oxoid catalogue #RE111103). This plate can neutralize antimicrobial chemicals for environmental sampling. Two sites were sampled from each curtain. The sample sites were on the side of the curtain facing the patient, near the edge hem, with 1 sample taken from above shoulder height and the other sample taken from below shoulder height. For every sample, the same Rodac plate was pressed against the curtain for 30 seconds. Curtain cultures taken on subsequent days were taken at the same vertical height on the curtain but lateral to the prior sample location to avoid contamination from previous sites. One culture plate was used for each curtain on days 1, 3, 7, 10, 14, 17, and 21.

Bacterial isolation and genotypic analysis

Contact plates were incubated at 37°C for 48 hours, and swab samples were streaked on Lysogeny Broth (LB) agar (Bacto LB Agar, Lennox, BD, France). CFUs were counted from each plate. Initially, phenotypic identification of MRSA strains was confirmed by growth on MSA-Oxacillin agar. SA003 (CA-MRSA #40065) was used as a reference strain throughout the study.

All MSA-Oxacillin-positive strains were further screened by nuclease (*nuc*) and *mecA* gene by the colony polymerase chain reaction method.

RESULTS

Table 1 shows the degree of contamination (CFU/cm²) for each curtain on each day. Contamination on day 1 was minimal, with mean CFU/cm² of 0.20 (control) and 0.10 (test). Control curtains

Table 1
Curtain contamination (CFU/cm²)*

	Day 1	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21
Curtain 1	0.35	1.48	1.30	1.80	1.66	X	X
Curtain 2	0.14	1.34	1.34	2.15	1.73	X	X
Curtain 3	0.07	0.60	1.16	1.59	0.81	2.68	3.32
Curtain 4	0.17	0.84	1.30	1.30	1.16	2.54	X
Curtain 5	0	1.73	1.02	1.02	1.84	1.27	X
Curtain 6	0.07	1.84	1.69	1.27	1.69	1.66	2.40
Curtain 7	0	0.67	2.22	2.76	1.02	1.98	3.39
Curtain 8	0.77	0.88	2.54	2.54	3.64	1.02	11.32
Mean	0.20	1.17	1.57	1.80	1.69	1.86	5.11
Control 1	0.10	0.24	0.21	0.31	0.24	0.56	0.74
Control 2	0.10	0.14	0.24	0.17	0.24	0.21	0.46
Mean	0.10	0.19	0.23	0.24	0.24	0.39	0.60

*X represents curtains that had been removed due to patient turnover or sanitation concerns.

Table 2
MRSA CFU count*

	Day 1	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21
Curtain 1	0	0	0	0	1	X	X
Curtain 2	0	0	1	0	2	X	X
Curtain 3	0	0	0	1	0	0	4
Curtain 4	0	1	0	0	1	0	X
Curtain 5	0	0	3	0	0	0	X
Curtain 6	0	0	0	0	0	2	2
Curtain 7	0	0	0	0	1	1	5
Curtain 8	0	0	0	0	1	1	0
Control 1	0	0	0	0	0	0	0
Control 2	0	0	0	0	0	0	0

*X represents curtains that had been removed due to patient turnover or sanitation concerns.

stayed clean over the 21 days (mean CFU/cm² = 0.60). Increasing test curtain contamination occurred over time, with an inflexion point occurring between day 17 and 21 (1.86 to 5.11 CFU/cm²).

The number of curtains that tested positive for MRSA increased progressively over time (Table 2). By day 21, 3 of the 4 curtains tested positive for MRSA.

DISCUSSION

To our knowledge, this is the first study to assess the trajectory of microbial contamination on curtains over time, with control curtains used for comparison. Patient curtains became increasingly contaminated despite starting at the same level as controls. Therefore, regular curtain contact that occurs in proximity to an occupied patient bed results in increasing colonization over time. Given that we sampled areas where people hold curtains, it is likely that the increasing contamination was because of direct contact.

To our knowledge, no set of standards exists for assessing hospital surface hygiene. However, it has been proposed that hospitals should be at least as clean as food preparation environments.⁸ For example, the United Kingdom has specified that food processing equipment should be <2.5 CFU/cm²; by day 21, 75% of remaining curtains exceeded this safety threshold.

The food industry also tests for the mere presence of certain high-risk organisms.⁸ Indeed, certain pathogens such as MRSA are associated with significant morbidity and mortality. By day 14, 87.5% of test curtains grew MRSA. Therefore, the 14-day mark may represent an important opportunity to intervene. Fourteen days were proposed in another study to be the minimum amount of time that curtains should hang before requiring intervention.⁹

The results of this pilot study must be interpreted within the context of its limitations. Most importantly, this study had a small sample size of 8 test curtains and 2 controls. Finally, the clinical consequences of contaminated curtains are still unknown.

CONCLUSIONS

Freshly laundered patient hospital privacy curtains have minimal contamination when first hung. After hanging for 14 days, most curtains tested positive for MRSA. By day 21, almost all curtains exceeded 2.5 CFU/cm². The presence of MRSA and the number of CFUs suggest that curtains are a source of cross-contamination in hospitals. These data suggest that interventions to clean or routinely replace curtains should occur approximately 14 days after the curtains are hung. Additional studies examining the relationship between curtain contamination and patient contamination should be undertaken.

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