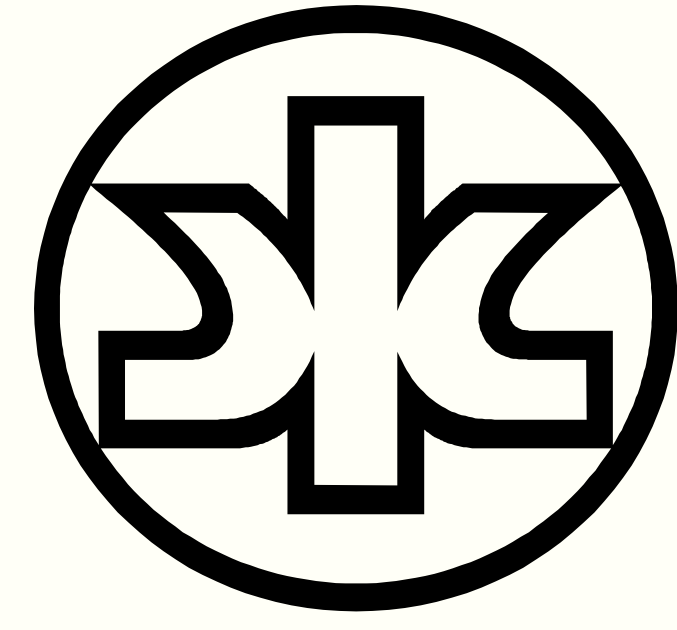


Microbial Load of Reusable Cleaning Towels used in Hospitals

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ABSTRACT

Hospital cleaning practices play a critical role in the prevention of nosocomial infection transmission. To this end, reusable towels soaked in disinfectants are commonly used to clean and disinfect hospital surfaces. There are reports linking reusable cleaning towels to the outbreak of *Bacillus cereus*. It is known that reusable towels can interfere with the action of commonly used quaternary ammonium disinfectants. It is therefore important to understand if reusable towels can increase the risk for the transmission of pathogens in the hospital. The objective of this study was to investigate the prevalence of bacteria and fungi in reusable cleaning towels.

Reusable towels used for cleaning hospital rooms contained high numbers of microbial contaminants. Hospital laundering practices in this study appear to be either insufficient to remove microbial contaminants or even add contaminants to the towels. Furthermore, towels are known to interfere with the action of common hospital grade disinfectants. Independently and together these two factors may increase the risk for transmission of pathogens in the hospital. Importantly, these observations point to the need to critically re-evaluate current hospital cleaning practices associated with the use of reusable towels.

MATERIALS AND METHODS

Hospital survey. Ten hospitals were surveyed regarding their cleaning practices after terminal discharge and the use of disinfectants.

Collection of towels. Laundered reusable cleaning towels were collected in triplicate from each hospital. Each collected towel was submerged in buffered peptone water (EMD Chemicals, Gibbstown, NJ) to extract microbes. The peptone broth was extracted from the towel by ringing the liquid out. The extract was assayed on selected media for the isolation of the various bacteria and fungi.

Sampling of soak buckets. The buckets used to soak the towels in disinfectants were sampled for 9 of the 10 hospitals. Each soak bucket was swabbed with a Sponge-Stick™ Swabs (3M™, St. Paul, MN) right above the disinfectant liquid line. Microbes were eluted from the Sponge-Stick™ Swabs in letheen broth with agitation. The extract was assayed on selected media for the isolation of the various bacteria and fungi.

Enumeration of target organisms. Quantitative plate count methods were used to determine the presence of heterotrophic bacteria, total coliform, aerobic spore formers, fungi, *Staphylococcus aureus*, methicillin resistant *S. aureus* (MRSA), *Escherichia coli*, and *Clostridium difficile*.

Identification of organisms. API® strips (bioMérieux, Durham, NC).



Hospital cleaning cart with a soak bucket and reusable cotton towels.



RESULTS

Numbers of Towels and Soak Buckets Positive for Microbes

	Viable Microbes	Total Coliform	<i>E. coli</i>	Aerobic Spore Formers	Fungi
Towels	28/30 ^a (93%) ^b	7/30 (23%)	1/30 (3%)	17/30 (56%)	4/30 (13%)
Soak Buckets	6/9 (67%)	1/9 (12%)	ND	4/9 (44%)	ND

ND = Not detected

^a Number positive per number sampled

^b Percent positive

Microbial Contamination on Reusable Cleaning Towels (Mean log CFU/Towel ± SD; n=3)

Hospital	Heterotrophic Bacteria	Total Coliform	Aerobic Spore Formers	Fungi
1	4.1 ± 0.2	0.5 ± 0.5	3.3 ± 0.2	0.9 ± 1.6
2	1.1 ± 1.9	ND	1.7 ± 1.5	ND
3	3.8 ± 0.8	0.3 ± 0.5	1.0 ± 1.7	ND
4	3.9 ± 0.3	ND	1.0 ± 1.7	ND
5	3.5 ± 0.6	ND	1.9 ± 1.6	ND
6	5.0 ± 0.1	1.3 ± 0.5	3.6 ± 0.3	3.3 ± 0.3
7	3.0 ± 0.1	ND	ND	ND
8	3.7 ± 0.5	ND	1.5 ± 1.3	ND
9	3.8 ± 0.1	ND	3.9 ± 0.6	ND
10	2.3 ± 2.0	ND	ND	ND

ND = Not detected

Microbial Contamination on Soak Buckets (CFU/100cm²; n=9)

Parameter	Heterotrophic Bacteria	Total Coliform	Aerobic Spore Formers
Mean	269	0.15	153
Max	1300	1.3	1320
Min	ND	ND	ND

ND = Not detected

Bacteria Identified on Towels and Soak Buckets

<i>Aeromonas hydrophilica</i>	<i>Pantoea</i> spp
<i>Escherichia coli</i>	<i>Pasteurella pneumotropica</i>
<i>Klebsiella oxytoca</i>	<i>Pseudomonas luteola</i>
<i>Klebsiella pneumoniae</i>	<i>Serratia plymuthica</i>
<i>Micrococcus luteus</i>	<i>Vibrio fluvialis</i>
<i>Moellerella wisconsensis</i>	

Methicillin resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* were not isolated from any of the towels or soak buckets.

Impact of Towel Material on Contamination (log CFU/Towel ± SD)

	Cotton		Microfiber		p-value ^a
	n	Mean	n	Mean	
Heterotrophic Bacteria	24	3.17 ± 1.29	6	4.39 ± 0.88	0.0381
Total Coliform	24	0.07 ± 0.23	6	0.78 ± 0.70	0.0002
Aerobic Spore Formers	24	1.66 ± 1.63	6	2.28 ± 1.80	0.4152
Fungi	24	0.12 ± 0.58	6	1.67 ± 1.84	0.0012

^aMultiple analyses of variance with a rejection region of 5% using the F distribution

SUMMARY

- Reusable cleaning towels used for cleaning and disinfecting hospital rooms contain microbial contaminants.
 - Both cotton and microfiber towels harbored microbial contaminants.
 - Microfiber towels contained significantly more bacteria than cotton towels.
 - 93% of the towels sampled contained viable microbes.
 - 56% of the towels sampled contained spores.
 - 23% of the towels sampled contained coliforms.
 - 3% of the towels sampled contained *E. coli*.
 - 67% of the soak buckets sampled harbored viable bacteria.
 - 44% of the soak buckets sampled harbored bacterial spores.
- Typical hospital laundering practices are not sufficient to remove microbial contaminants in towels whether sent out to a central laundering facility or laundered in house.
- Although hospital grade disinfectants show efficacy against the microorganisms found in the towels, it appears that treatment practices should be re-evaluated.