

Partnering to Improve Hospital Environmental Cleaning and Reduce Microbial Contamination

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OBJECTIVES

- 1) Review evidence that environmental contamination contributes to healthcare associated infection;
- 2) Discuss attitudes and beliefs that may influence the effectiveness of cleaning in hospital,
- 3) Discuss strategies to improve environmental cleaning in hospitals.

SUPERBUG TO KILL 150,000

Minister or health chief deadly NH

Hospitals battling outbreaks of *C. difficile*

Published at www.cmaj.ca on June 4, 2004. Revised on June 14, 2004.

See related articles pages 27, 33, 45, 47 and 51

More people have died after contracting a virulent infection that has broken out in hospitals in Montreal and Calgary than were killed by SARS — yet neither public health nor hospital officials warned the public until...

"I believe that we have a new [strain] that seems to be quite virulent," says Dr. Vivian Loo, director of infection prevention and control at the McGill University Health Centre. "It's a huge challenge."

The infection occurs in some...

Proper hand-washing is essential to controlling *C. difficile*.

Woman Becomes Quadruple Amputee After Giving Birth: Local woman wants answers

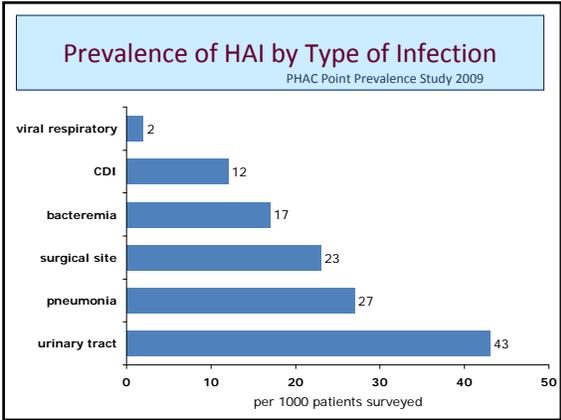


January 26, 2007, Orlando Florida
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National and International Patient Safety Collaboratives

How Common Are Adverse Events?

	AE rate	Preventable
NY 1984	3.7%	n/a
Utah/Col 1992	2.9%	n/a
Australia 1992	16.6%	51%
NZ 1998	13.1%	37%
UK 1999	10.8%	48%
Denmark 2000	9.0%	40%
Canada 2001	7.5%	37%



HAI Prevalence in CNISP Hospitals: Comparison of 2002 and 2009

PHAC 2010

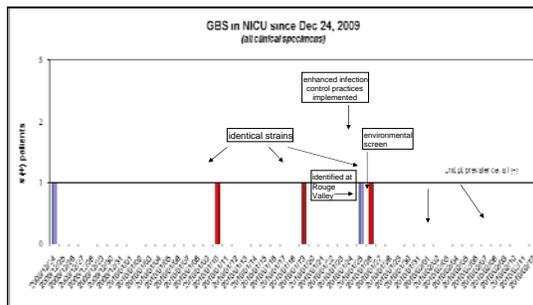
	2002	2009	
# centres	25	49	
# patients	6747	9953	
# HAIs/ 1000 pts	112	124	$P < 0.0001$



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TIME LINE OF GBS INFECTION IN SICKKIDS' NICU

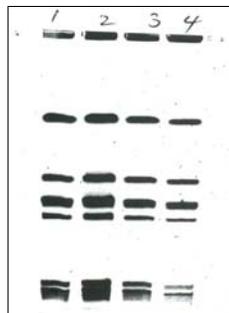


Areas sampled



PFGE of NICU GBS isolates

Lane 1 - pt. 1 GBS from blood
 Lane 2 - pt. 2 GBS from ETT
 Lane 3 - Environmental, monitor
 Lane 4 - pt. 3 GBS from blood



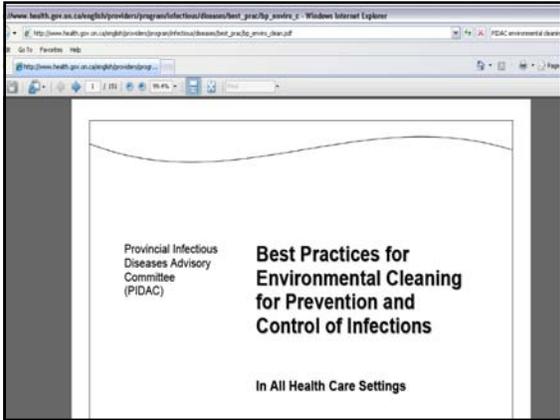
Viruses on Reservoirs

Virus	Hard Surfaces	Cloth	Skin
RSV	8 hours	1 – 2 hours	25 min.
Flu A/B	24-48 hours	8-12 hours	5 min.
Rotavirus	8 days-wks		days
HIV	2 hours		
Hep A	2 weeks		
Hep B	> 1 week		

Survival of methicillin resistant *Staphylococcus aureus*, vancomycin-resistant enterococcus and *C. difficile* on dry inanimate objects

BACTERIUM	DURATION OF SURVIVAL
<ul style="list-style-type: none"> Methicillin resistant <i>Staphylococcus aureus</i> 	<ul style="list-style-type: none"> 7 days to 7 months
<ul style="list-style-type: none"> vancomycin-resistant enterococcus 	<ul style="list-style-type: none"> 5 days to 4 months
<ul style="list-style-type: none"> <i>Clostridium difficile</i> spores 	<ul style="list-style-type: none"> 5 months

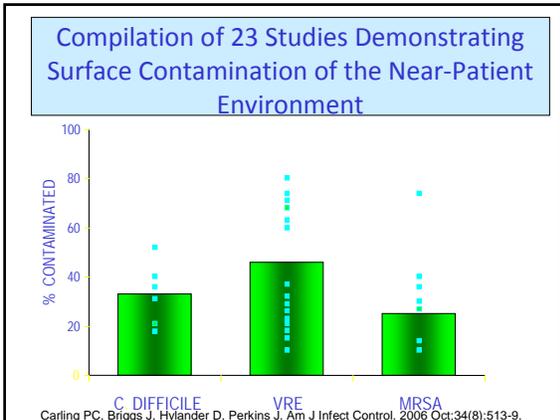
Kramer A, Schwelke I, Kampf G. How long do nosocomial pathogens persist on inanimate objects? A systematic review. BMC Infectious Diseases 2006; 6:130



BOX 1: Criteria for Evaluating the Strength of Evidence for Environmental Sources of Infection (listed in order of strength)

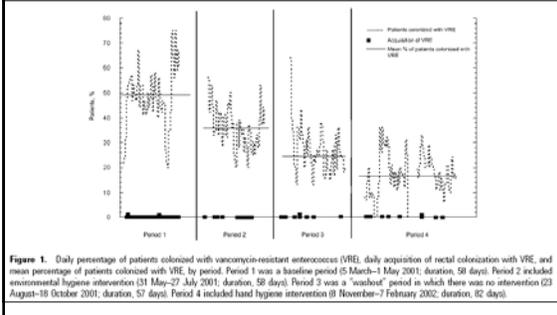
1. The organism can survive after inoculation onto the fomite.
2. The organism can be cultured from in-use fomites.
3. The organism can proliferate in or on the fomite.
4. Some measure of acquisition of infection cannot be explained by other recognized modes of transmission.
5. Retrospective case-control studies show an association between exposure to the fomite and infection.
6. Prospective case-control studies may be possible when more than one similar type of fomite is in use.
7. Prospective studies allocating exposure to the fomite to a subset of patients show an association between exposure and infection.
8. Decontamination of the fomite results in the elimination of infection transmission.

Source: Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC)



Reduction in acquisition of VRE after enforcement of routine environmental cleaning measures.

Hayden et. al, CID, 2006



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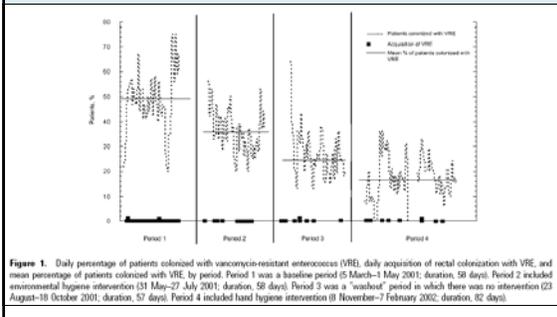


Table 3. Interventions and bacterial contamination with vancomycin-resistant enterococcus (VRE), by study period.

Intervention, variable	Period 1	Period 2	Period 3	Period 4	P ^a
Environmental contamination					
No. of cultures	1646	1346	1462	1697	
Environmental contamination rate ^b					
Before cleaning, mean ± SD	0.15 ± 0.08	0.07 ± 0.05	0.05 ± 0.04	0.06 ± 0.05	<.0001
After cleaning, mean ± SD	0.1 ± 0.06	0.04 ± 0.04	0.03 ± 0.02	0.04 ± 0.04	<.0001
Cultures of samples from rooms with VRE-positive patients					
No. of cultures	1215	960	902	756	
Cultures positive for VRE, no. (%) of cultures	287 (23.6)	112 (11.7)	92 (10.2)	127 (16.8)	<.0001
Cultures of samples from rooms with VRE-negative patients					
No. of cultures	431	386	560	941	
Cultures positive for VRE, no. (%) of cultures	22 (5)	3 (0.7)	5 (0.9)	22 (2.3)	<.0001

- Observed housekeepers work EACH day of the week
- 7 Housekeepers worked in MICU during study period
- A SINGLE HOUSEKEEPER CLEANED THE MAJORITY OF ROOMS!

Hayden et. al, CID, 2006

Potpourri of MRSA literature

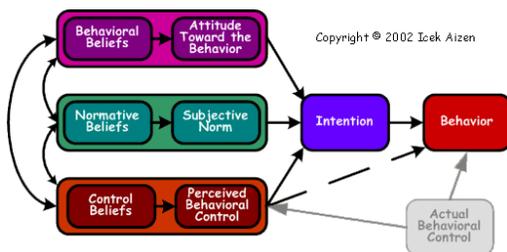
- **Association with nurse understaffing.** Dancer SJ et al. MRSA acquisition in an intensive care unit. *AJIC* 2006 Feb;34(1):10-17.
- **Widespread ICU contamination. Evidence to suggest 3/26 got MRSA from the environment.** Hardy KJ, et al. A study of the relationship between environmental contamination with methicillin-resistant *Staphylococcus aureus* (MRSA) and patients' acquisition of MRSA. *ICHE* 2006 Feb;27(2):127
- **Increased odds of colonization with exposure to a patient with nosocomially acquired MRSA** Moore C et al Risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) acquisition in roommate contacts of patients colonized or infected with MRSA in an acute-care hospital. *ICHE* 2008;29(7):600
- **MRSA Bundle.** Griffin FA. Reducing methicillin-resistant *Staphylococcus aureus* (MRSA) infections. *Joint Commission Journal on Quality and Patient Safety*. 2007 Dec;33(12):726-731.
 1. Hand hygiene
 2. Decontamination of the environment and equipment
 3. Active surveillance cultures (ASCs)
 4. Contact precautions for infected and colonized patients
 5. Compliance with Central Venous Catheter and Ventilator Bundles



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THEORY OF PLANNED BEHAVIOUR



Assessment of the Knowledge and Predictors of Behaviour in Patient Service Assistants Regarding Environmental Cleaning in a Pediatric Hospital

To assess PSA/housekeeping staff knowledge, attitudes and beliefs regarding their roles in cleaning patient environments as a means of preventing infection.

To evaluate the effectiveness of an educational approach that takes into account the knowledge, attitudes and beliefs of PSA/housekeeping staff.



Anne Mallow, Rick Wray, Susan Richardson

THE PROJECT

Phase 1

- Baseline assessment of cleaning
- Baseline assessment of PSA knowledge, attitudes and beliefs

Phase 2

- Educational intervention

Phase 3

- Reassessment of cleaning
- Reassessment of PSA knowledge, attitudes and beliefs

OVERALL METHODS

- Microbiological testing
 - Swab pre-determined sites in patient zones after cleaning
- Assessment of knowledge, attitudes and beliefs
 - Written survey
 - 20-30 minute focus groups
- Educational intervention
 - 2-4 hour educational workshop based on findings of surveys and focus groups

RESULTS

16 questionnaires(53%) were returned.

KNOWLEDGE:

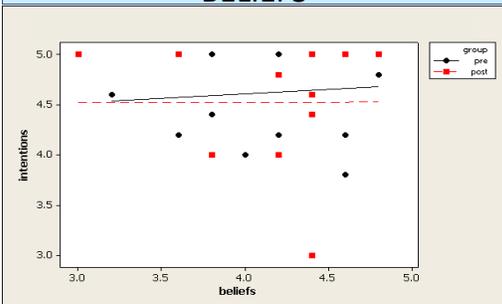
37% of PSAs did not think the environment has germs that can cause disease.

25% did not think the disinfectants were safe for children.

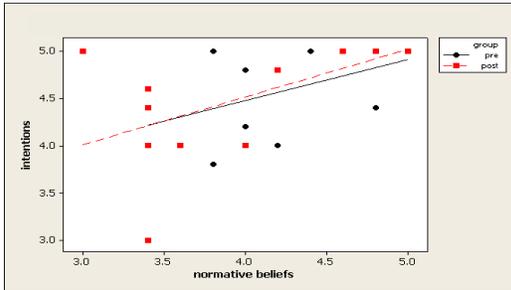
RESULTS IN TERMS OF TPB

- **ATTITUDES AND BELIEFS ABOUT OUTCOMES**
- work important for patient safety 100%. worried about getting sick from infected patients 7/15 (46%) and worried about being harmed by the products 8/15 (55%).
- **NORMATIVE BELIEFS AND SUBJECTIVE NORMS:**
- mattered to families /patients to do a good job. 12/16 (75%)
- nurses, MDs and other PSAs expected them to do a good job and that their supervisor knew when they did a good job 13/16 (81%)
- did a good job to please themselves 12/16 (75%)
- **CONTROL BELIEFS: PERCEIVED BEHAVIOURAL CONTROL:**
- time to clean but too many interruptions 9/16 (56%)
- **INTENTION:** intend is to clean well 100%.

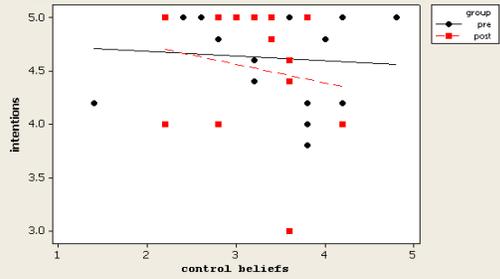
INTENTION VS BEHAVIORAL BELIEFS



INTENTION VS NORMATIVE BELIEFS



INTENTION VS CONTROL BELIEFS



Areas marked



Patient specific equipment	Common equipment
Keys and silence button of monitor	Rocking chair arms (for parent)
Computer keyboard (ASERTLN), space bar	Patient supply cart front and top
Mouse	Refrigerator door handle
Thermometer, front and top	Sink rim - top and front
IV pump buttons	Diaper scale - front and tare button
Intercom buttons	Phone handle
Room light switch and plate	Room door handles, outer and inner
Patient lamp switch	
Chair seat (for parent)	
Chair, back and front (for parent)	

Microbial contamination before and after educational intervention

Table 2

		Patient-specific surfaces contaminated (%)	P value	Mean # surfaces contaminated (range)	Common surfaces contaminated (%)	P value	Mean # surfaces contaminated (range)
Pre-Intervention	Pre-Cleaning	29/207 (14%)	0.0074	1.2 (0-4)	46/168 (27.4%)	0.0037	1.9 (0-5)
	Post-Cleaning	16/196 (8.2%)		0.7 (0-4)			20/168 (11.9%)
Post-Intervention	Pre-Cleaning	33/228 (12.8%)	0.0074	1.1 (0-3)	52/201 (25.9%)	0.0001	1.7 (0-6)
	Post-Cleaning	9/251 (3.6%)		0.3 (0-1)			12/198 (6.1%)

Focus Group Themes

- “Me/ us versus them”
 - when new PSAs come to the unit, we have to reclean after they do their work oh so many times”
 - supervisor needs to have more involvement and oversee what’s being done
- Effort –reward imbalance
 - Some nurses have no respect for work done: like the med room: after just cleaned [they] take what they need and leave stuff all over”.

Focus Group Themes 2

- Competing priorities
 - “I organize my time. If the call is important I stop and go, but if it is not important I continue cleaning and then I answer a call”.
- Sense of Responsibility
 - you put yourself in the parent’s place having a sick child in the hospital and you would like to know that if it was your child a proper job was done before occupying the bed
 - Don’t feel comfortable cleaning electronic equipment

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Direct and Indirect Observation

PIDAC 2009

***Answers the Question:
Does It ‘Look’ Clean?***

- Visual assessment
- Observation of performance
- Patient/resident satisfaction surveys

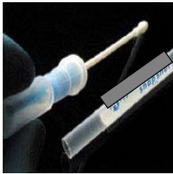
Residual Bioburden

**Answers the Question:
Are Microorganisms Still Present?**

- Environmental culture
- ATP bioluminescence

ATP bioluminescence

Swab surface → luciferase tagging of ATP → Hand held luminometer



"Additional studies from multiple health care settings are needed before a standardized ATP bioluminescence breakpoint can be established for defining surfaces as adequately cleaned." PIDAC 2009

Environmental Marking

**Answers the Question:
Was Anything Missed?**

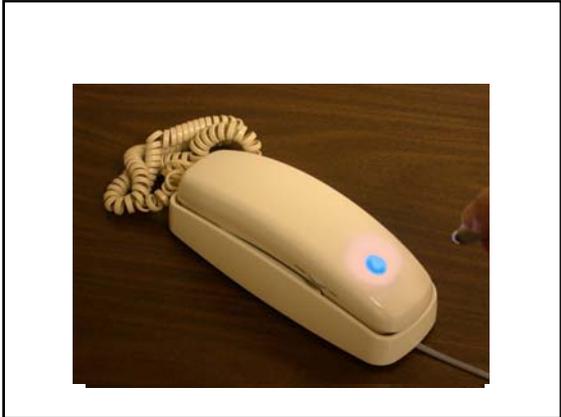
- Environmental marking tools

Development of a new targeting tool...

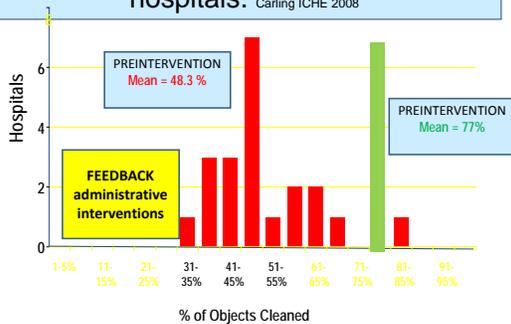
- *Novel* and *innovative* metric
- Proprietary combination of glues, soaps and a fluorescence targeting dye
- Easily applied; dries in 10-15min



Dr P Carling
Slide courtesy of J Po



Improving cleaning of the environment surrounding patients in 36 acute care hospitals. Carling ICHE 2008



PUTTING IT ALL TOGETHER

- The environment is a reservoir for pathogens, and environmental cleaning/ disinfection is a key strategy to decrease HAI
- Changing behaviour is complex; need to appreciate what drives behaviour (TPB)
- Housekeepers(peds) intend to do a good job; normative beliefs are important...?generalizable
- Education must target their attitudes and beliefs
- Feedback important; treat as team member
- Monitoring for quality assurance is becoming a new norm

THANK YOU

“What is essential is invisible to the eye”

