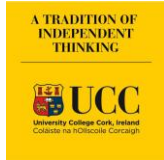




# Infection Prevention and Control A Foundation Course 2014



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## Cleaning and Decontamination of the environment: the least we can do.

Dr D Corcoran



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## Are targets in Infection Control helpful?



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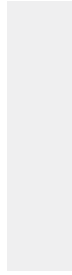
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## Targets in Infection Control

- Hand Hygiene
- MRSA



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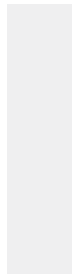
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## The danger of targets

- They become ends in themselves and the perception of the target becomes the reality of the problem.
- Correction of the underlying problem may become confused with achieving targets.



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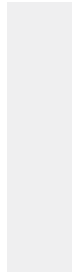
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## Basics of Infection Control

- The least we can do, and the most we can do?
- Hand Hygiene
- Clean patient environment
- Environment is neglected as the target is usually Hand Hygiene



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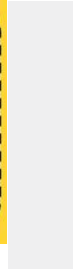
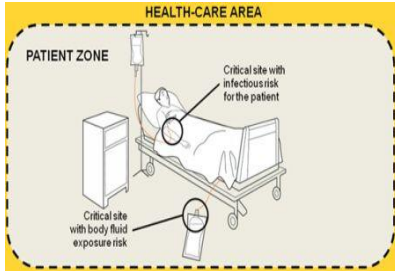
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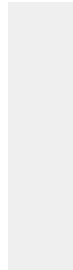
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### Rationale

- The patient zone is rapidly contaminated by the patient's flora
- Corollary is that all surfaces are cleaned regularly and, also, after the patient is discharged




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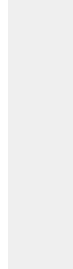
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### Clean patient environment

- Why is there even a debate about hospital cleaning?
- *"Hospitals should gleam"* SJ Dancer
- Cleaning has always been taken for granted
- (NB "Hospital" = any healthcare facility, the approach will differ in degree)




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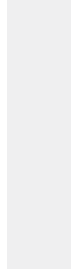
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## Why the debate?

- Is there evidence? cleaning has never been regarded as an evidence-based science.
- Aesthetic considerations make cleaning difficult to assess.
- No way of measuring the cleaning process nor its impact on the environment.
- Confounded by fabric and maintenance deficits.
- We cannot see the organisms.
- It costs money.



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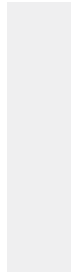
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## N.B.

### More to cleaning than floors and toilet areas



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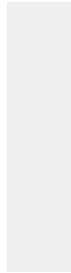
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## Some hardy invaders

- *Clostridium difficile*
  - Norovirus
  - *Acinetobacter spp*
  - Vancomycin-resistant enterococci (VRE)
  - *Staphylococcus aureus* including MRSA
- What makes these organisms particularly important regarding hospital cleaning?



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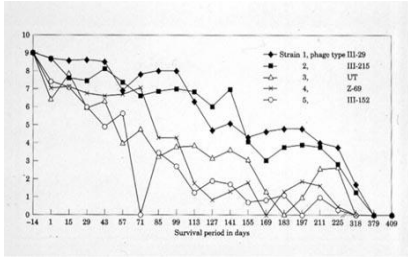
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### Survival of different strains of MRSA in hospital dust




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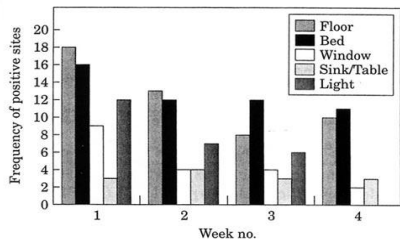


Figure 1 Summary of location distribution of *Clostridium difficile* by weeks, showing frequency at which each sample site was positive during the study period.

Verity et al, 2001




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### Clostridium difficile

- *J Hosp Infect* 2012; **80**:1-5. Best et al
- Aerosolised by toilet flushing
- Many hospital lavatories do not have lids
- Recoverable from air 25cm above seat
- Surface contamination noted from 90 min




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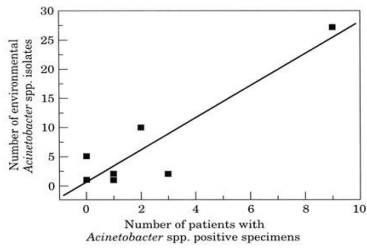
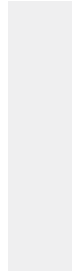


Figure 1 Graph showing relationship between number of patient isolations and environmental isolations of the outbreak strain of *Acinetobacter baumannii* obtained during the same calendar month.



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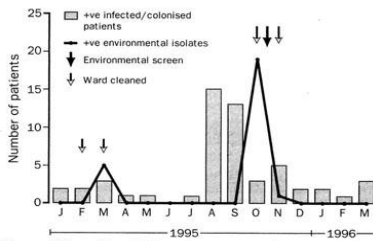
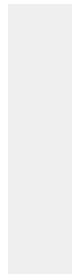


Figure: Effect of hospital cleaning on GRE in patients and environment  
Chadwick and Oppenheim, 1996



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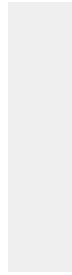
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## Where is MRSA in a hospital? (MRSA as a marker)



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**Sites which yielded the outbreak MRSA – more than half are hand touch (HT)**



Environmental Site		Total +ve (%)	Total Screened
Furniture	HT	12 (11.3)	106
Floor		7 (8.6)	81
Medical Equipment	HT	16 (13.2)	121
Bed	HT	6 (4.7)	128
Flat Surfaces		6 (6.6)	91
Door handle	HT	3 (10.7)	28
Ventilation duct/grill		4 (8.3)	48
Radiator	HT	16 (36.4)	44
Nurse call button	HT	2 (7.7)	26
		72 (10.7)	673

Rampling et al, *J Hosp Infect* 2001



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**Is the perception of cleanliness accurate?**



82-91%    Visually clean  
 10-24%    ATP clean  
 30-45%    Microbiologically clean

What is clean?  
 "what an individual thinks it is"??  
 We should not define cleanliness without indicating how we would assess it

Griffith CJ et al , *J Hosp Infect* 2000



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**Monitoring of cleaning is difficult**



- Mulvey et al *JHI* 2011;77:25-30
- Confirms that visual inspection is not adequate
- Suggested a level of ATP bioluminescence may correlate to a degree with level of microbial soiling
- ATP/culture methods may help identify soiling and therefore risk if collected over time an interpreted accurately
- This is both difficult and expensive



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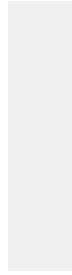
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## Why hand contact surfaces?

- Creamer et al *JHI* 2010; **75**:107-111, sampled HCW hands on 822 occasions.
- After clinical contact
- After contact with clinical environment
- After hand hygiene
- With no hand hygiene




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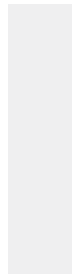
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## Creamer et al 2010

- MRSA recovered from 38 (5%) of HCW fingertips of 822 occasions
- 12/194 after clinical contact (6%)
- **10/138 after patient environment contact (7.2%)**
- 15/346 with no specific contact (4%)
- After hand hygiene
- 3% (2/61) after alcohol hand rub
- 6% (2/35) after chlorhexidine wash
- 3% (7/210) after soap and water wash
- No Hand Hygiene - 5% (27/493)




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## C.difficile, VRE and MRSA are found on hand-touch sites in the clinical environment

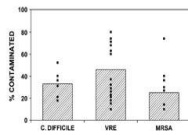
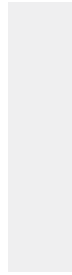


Fig 1. The proportion of environmental surface cultures positive for C. difficile, VRE, and MRSA reported in the literature. Each point represents a separate study and the column, the mean for that pathogen<sup>14,17</sup>

	VRE	MRSA	C. difficile
Bed Rails	+++++	+	***
Bed Table	+++++	+	***
Door Knobs	**	**	+
Doors	***	+	
Call Button	+++	+	**
Chair	**	+	**
Tray Table	+++	**	**
Toilet Surface	+	**	****
Sink Surface	+	+	***
Bedpan Cleaner			+

Fig 2. The relative frequency with which surfaces in the near patient environment have been found to culture VRE, MRSA, and C. difficile. Each + represents a single report in the literature. (15,18,37,38,13,35,79,40,41,42,43,44)

Caring et al. AmJIC, 2008




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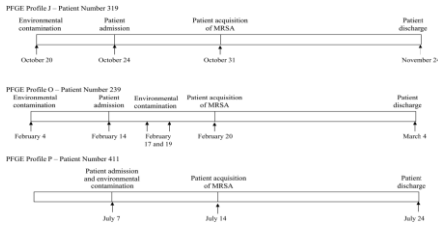
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- Evidence for transmission of MRSA with pulsed-field gel electrophoresis (PFGE) profiles J, O, and P from the environment to patients in an intensive care unit. The time lines highlight the dates when MRSA was isolated from the environment, when the patients were admitted, and when they acquired MRSA. During the time that these patients were hospitalised, no other patients in the intensive care unit were colonised with MRSA with the same PFGE profile.
- Hardy et al IJCHE 2006



## Are hand-touch sites routinely cleaned?

- Routine cleaning practices were assessed by applying a fluorescent solution to different sites in side-rooms.
  - 40% sites were cleaned properly, they tended to be the more traditional sites (toilets and sinks) whereas sites such as telephones, doorknobs and other hand-touch surfaces were scarcely cleaned at all.
- Briggs & Carling, Am J Infect Control, 2006



## Reduction in VRE after improving cleaning & hand-hygiene

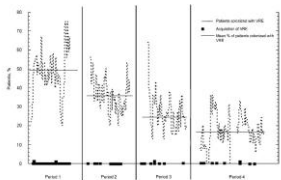


Figure 1. Daily percentage of patients colonised with vancomycin-resistant enterococci (VRE). Daily acquisition of nasal colonisation with VRE, and mean percentage of patients colonised with VRE, by period. Period 1 was a baseline period (5 March-3 May 2001, duration, 58 days). Period 2 included environmental hygiene intervention (23 May-27 July 2001, duration, 58 days). Period 3 was a 'washout' period in which there was no intervention (27 August-18 October 2001, duration, 52 days). Period 4 included hand hygiene intervention (8 November-7 February 2002, duration, 62 days).

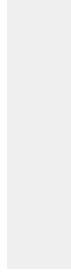
Hayden et al CID 2006



## Newer techniques

- Hydrogen peroxide gas (NB)
- Copper biocide (residual effect noted)
- Ultramicrofibre (UMF) mops (polyester/polyamide)
- UMF + Copper based biocide

(Hamilton *et al JHI* 2010;**74**:62-71)



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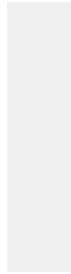
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## Hydrogen Peroxide

- Reaches all areas
- Useful in outbreaks
  
- In addition to cleaning
- Expensive
- Requires room downtime



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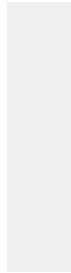
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## Remember: Hand Hygiene and Cleaning are a package

- The effects of hand hygiene are eroded if the environment is heavily contaminated with MRSA

*Farr et al, LI D, 2001*



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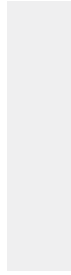
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## Hospital cleaning?

'...there is no magic solution and no complicated formula for cleaner hospitals. If we want to fight off the resistant organisms, we must have more time for cleaning...'



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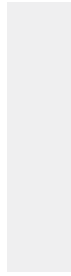
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## epic3 Guidelines 2014

- The hospital environment must be visibly clean; free from non-essential items and equipment, dust and dirt; and acceptable to patients, visitors and staff.
- Levels of cleaning should be increased (and disinfection considered) in cases of infection/colonisation when a known or suspected pathogen can survive in the environment, an environmental contamination may contribute to the spread of infection.



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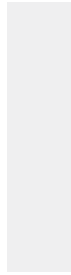
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## epic3 guidelines 2014

- Equipment used in patient care must be cleaned and decontaminated after each use with products recommended by the manufacturer.
- Healthcare workers need to be educated about maintaining a clean and safe care environment.



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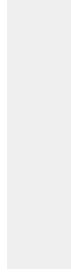
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## Equipment

- Consider it as part of the patient environment
- A systematic review of the literature identified healthcare equipment as a “potential vector for the transfer of microorganisms” and a significant source of healthcare –associated infections.

(Schabrun and Chipchase, pg. 245, 2006)




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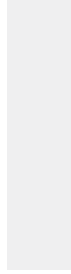
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## Aim of equipment decontamination

- Infection Prevention and Control Objective
- Prevent potentially pathogenic microorganisms from reaching a susceptible site on a patient / client in sufficient numbers to cause infection.




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Risk Assessment - Decontamination Method		
Risk	Application of Item	Recommendation
High	In close contact with a break in the skin or mucous membrane or for introduction into sterile body areas	Sterilisation
Intermediate	In contact with mucous membranes or contaminated with particularly virulent or readily transmissible organisms or prior to use on immunocompromised patients	Sterilisation or Disinfection required
Low	In contact with healthy skin or not in contact with the patient	Cleaning

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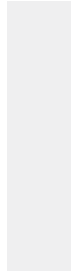
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## Single use means single use!

- "A device designated for "single-use" must not be reused. It should only be used on an individual patient during a single procedure and then discarded".  
(Medicines and Healthcare Products Regulatory Agency, UK).
- Medical Devices designated for single use are not reused under any circumstances.  
(Compliance with the HSE Medical Devices and Equipment Standard, 2009)



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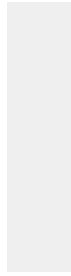
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## Single Patient / Client Use

- A medical device that is intended for single-client use means that the device may be used for more than one episode of use on one client only. The device may be reprocessed between each use as per manufacturer's instructions e.g. nebuliser tubing.
- 'Single patient / client use' should be used for one patient / client only and not reused on a different individual under any circumstances.  
(Department of Public Health HSE East Community Infection Prevention & Control Manual 2011).



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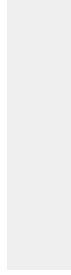
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## Equipment: important points

- Always follow the manufacturer's instructions.
- Refer to the HSE National Cleaning Manual Appendices (2006) if information specific to items of equipment is required.
- To ensure good management of both the environmental and equipment an audit system should be used to monitor and ensure adherence to organisational and national standards.



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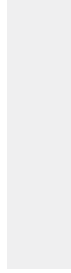
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## Conclusion: Key messages

- There is a clear link between hospital-acquired infections and inadequate hospital cleaning.
- Hand Hygiene and Environmental Cleaning are a package
- Beware the miracle cure; our defence against healthcare-associated infection is hard work.



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