



**Evaluating hygienic
cleaning in health care
settings: how to
benchmark?**

Dr S Luk



Environmental cleanliness

- Importance
- Audit & Benchmark
- Strategies



Cleanliness as a proxy for general quality

- 99% of the public felt that ‘ a clean hospital’ was vital in preventing infections
- ‘You are in safe hand’
- Supports other infection prevention practices





Pathogens do survive long in the environment

C. difficile	>5 months
S. aureus	7 months
VRE	4 months
Acinetobacter	5 months
Norovirus	3 weeks
Rotavirus	3 months



Patients do contaminate the environment

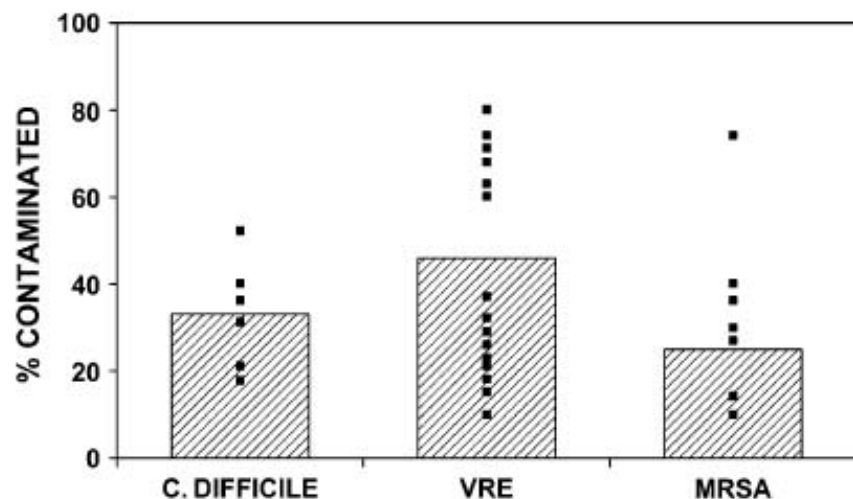


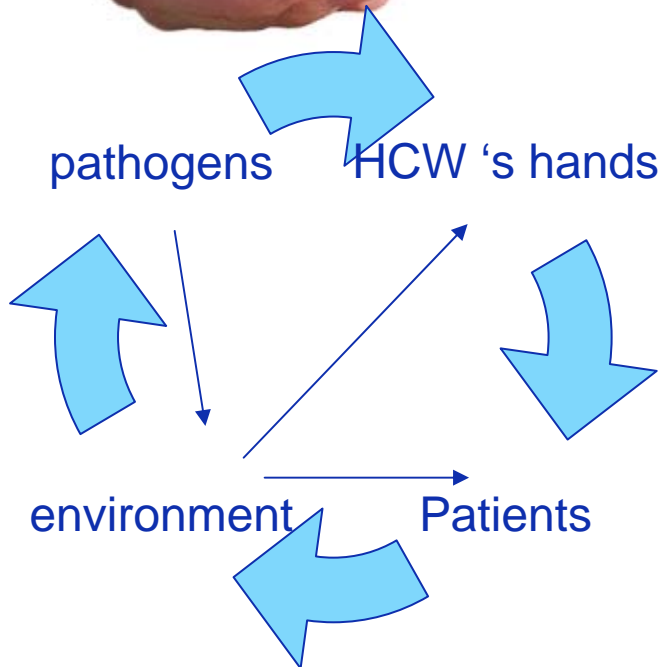
Fig 1. The proportion of environmental surface cultures positive for *C difficile*, VRE, and MRSA reported in the literature. Each point represents a separate study and the column, the mean for that pathogen.²⁶⁻⁴⁷

	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.^{19,21,26,27,30,31,33-36,39,40,42-44,46-49}

Depends on whether patient has diarrhea, open wound or no. of sites of colonization.

Environmental contamination does contribute to hospital infection



Literature Support for Improving Healthcare Environmental Cleaning

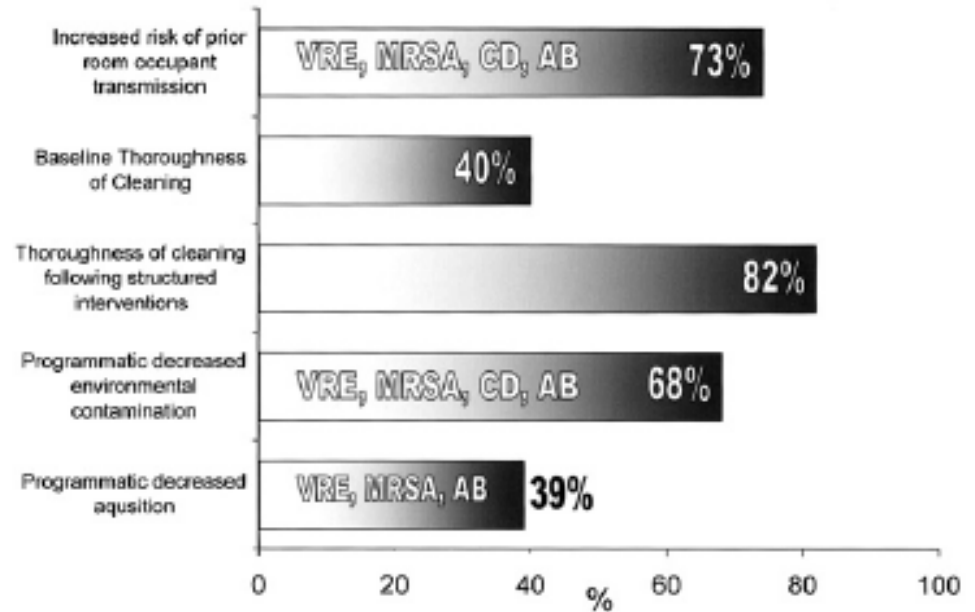


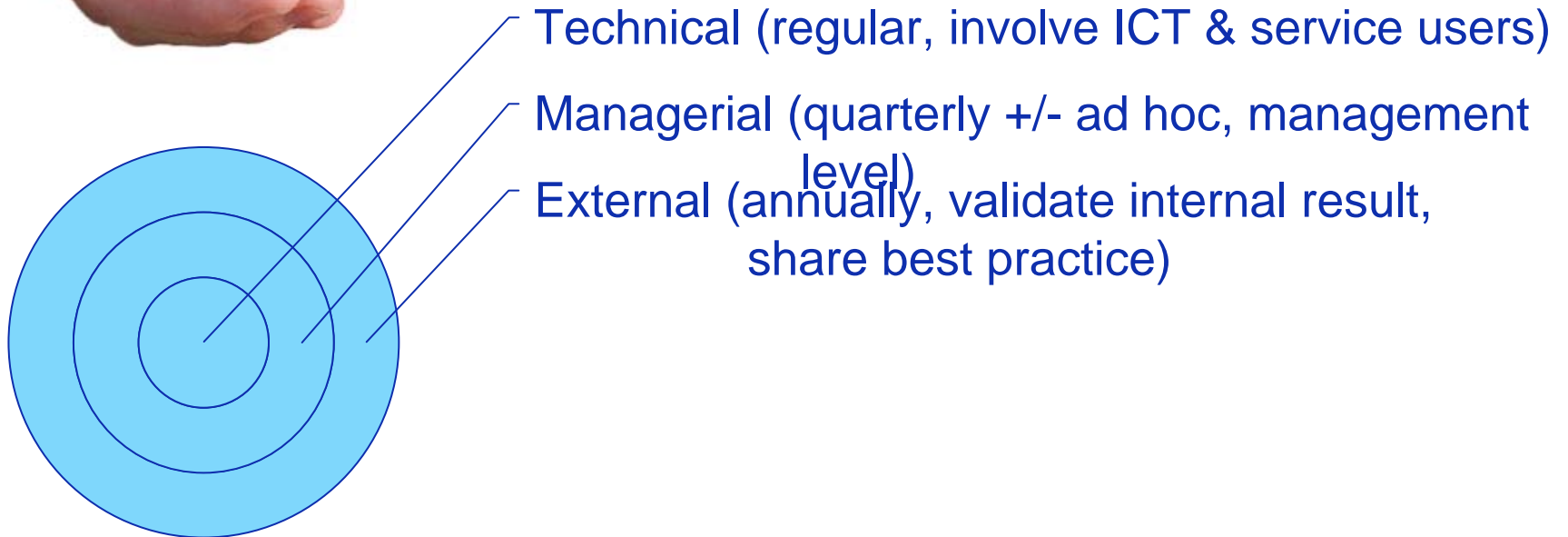
Fig 1. Summary of studies that provide support for improving health care environmental cleaning practice.

(Am J Infect Control 2010;38:S41-50.)

24% & 16% high-touch surfaces contaminated with MRSA & VRE after cleaning

Infect Control Hosp Epidemiol 2009; 30:678-4.

Audit



Technical (regular, involve ICT & service users)

Managerial (quarterly +/- ad hoc, management level)

External (annually, validate internal result, share best practice)

Risk categories

Target Frequency

• Very high risk invasive procedures or immuno-compromised patients e.g. ICUs, OT	98%	monthly
• High extensive & frequent contact; as reservoirs of infection e.g. general wards	95%	Twice monthly
• Significant moderate direct contact & unlikely as reservoirs of infection e.g. OPD, lab	85%	Every 3 months
• low little or no direct contact & unlikely as reservoirs of infection e.g. admin area	75%	Twice a year

National specification for cleanliness in the NHS

Table 1. Topic areas included in the ACE audit checklist

Section	Topic area
A	Documentation and management of cleaning
B	Risk in relation to cleaning design
C	Targets
D	Training and education of staff involved in cleaning
E	Equipment, consumables, and disinfectants used in cleaning
F	Personal protective clothing/uniform
G	Substances hazardous to health
H	Cleaning storeroom/equipment
I	Hospital cleaning contracts/cleaning hygiene and allied support services contracts
J	Collaborative approach to environmental cleanliness
K	Routine cleaning of clinical and public areas
L	Terminal cleaning of patient areas
M	Routine cleaning of isolation room/source isolation room
N	Management of high-risk soilage
O	Cleaning during building, upgrading, and demolition work in health care premises
P	Personal hygiene

Quarterly report on cleanliness

1. Overall cleanliness score

The overall score remains good and the upward trend continues. The introduction of steam cleaning (see below) has improved the scores of the rooms in which it is currently being used.

August: 95.1
September: 95.2
October: 95.3
Quarter: 95.2

Annual Trend:

FY 09/10	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Score	94.2	94.5	94.5	94.6	95.1	95.2	95.3					

2. Thirteen week review

In the previous reporting period, four functional areas failed to achieve target scores in one or more monthly audits. These were Heather, Samphire and Aster Wards, and Physiotherapy A. Action plans were put in place for these areas, which have been successful. The October scores for these areas were:

Heather: 95.6
Samphire: 95.9
Aster: 95.4
Physiotherapy A: 96.8

Only one functional area failed to reach its required target score in this reporting period, Clover Ward, which scored 86.9 in September and 89.2 in October. An action plan is in place to remedy this.

3. Cost of the cleaning service

Variations to contract totalling £xxxx in September and £xxxx in October were paid to (contractor's name) in the reporting period. A contingency allowance for additional outbreak cleaning was made for FY 09/10, and the overall cost of the service remains within the budget and forecast figures.

Period 5: £xxxxx
Period 6: £xxxxx
Period 7: £xxxxx

Annual Trend:

FY 09/10	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Cost	xxx	xxx	xxx	xxx	xxx	xxx	xxx					

5. Response to requests

Response to requests for cleaning services made via the helpdesk remains exceptionally good, with only two recorded failures to respond to a request within the contractual response times. Both have been investigated and found to be failures to record the response, rather than failure to deliver the service.

Period 5: 79 requests received, 79 responded to within contractual response time
Period 6: 75 requests received, 73 responded to within contractual response time
Period 7: 69 requests received, 69 responded to within contractual response time

Annual Trend:

FY 09/10	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Response %	97.8	100	100	98.2	100	97.0	100					

6. Recorded visits to functional areas by cleaning supervisors

For the first time in 2009/10, not all scheduled visits were made in Period 5. On investigation, this was found to be due to the immediate response to the infection outbreak starting on 18 August, and was remedied in the two successive periods.

Period 5: 168 visits scheduled, 153 visits recorded
Period 6: 168 visits scheduled, 168 visits recorded
Period 7: 168 visits scheduled, 168 visits recorded

Annual Trend:

FY 09/10	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Recorded %	100	100	100	100	91.0	100	100					

7. Actions arising from review of cleaning service July 2009, following publication of the new NHS Cleaning Manual

The action plan presented in detail in the August 2009 quarterly report has been largely completed. The remaining outstanding actions are:

a. Work Schedules

Work schedules are written, agreed, issued and displayed in all areas except Acute Assessment Unit. It is anticipated that this work schedule will be agreed before 21 November 2009.

b. Cleaning Method Statements

Written draft cleaning method statements have been created for all cleaning tasks. These are to be formally agreed at the next meeting of the method statements working party scheduled for 11 November 2009.

c. Training Records

The training records audit in September 2009 found several apparent gaps. A rectification plan is being worked through, with a target completion date of 18 November 2009.



Visual assessment

- Soilage of surfaces by potentially infectious material or dust & dirt
- Gross lapses
- Scoring system
 - Room / Functional area / overall – take into account of bed numbers
 - 0 – unacceptable
 - 1 – acceptable

[illegible]

Functional area

Overall percentage score #DIV/0!

Documentation

Patient Equipment – Cleaning Responsibility Form

Item of Equipment	Responsibility (Domestic, Maintenance or Nursing)	Cleaning process (Agent/ Method)	Frequency	Comments

CLEANING CHECKLIST FOR ISOLATION ROOMS

DISPOSABLE APRON	YES/NO	
DISPOSABLE GLOVES	YES/NO	
MASK	YES/NO	
LINEN	INFECTED/NON-INFECTED	
WASTE	CLINICAL WASTE BAG	
EQUIPMENT	COLOUR-CODED MOP AND BUCKET ALLOCATED TO A SINGLE PATIENT (note this equipment should be stored in the patient's room for the period of isolation)	
SUPPLIES	PAPER TOWELS, LIQUID SOAP, ALCOHOL HANDRUB etc.	
GENERAL SURFACE CLEANER AND/OR GENERAL PURPOSE DETERGENT	SPECIFY TYPE	



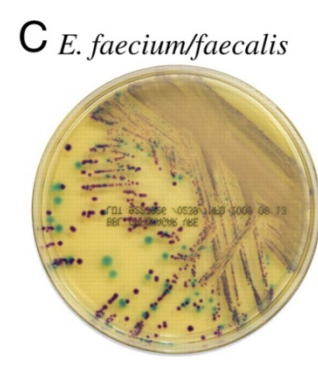
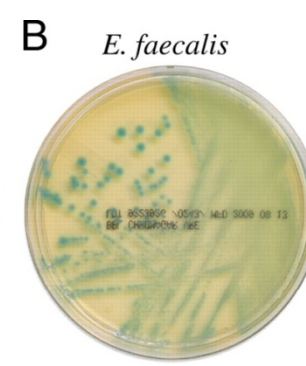
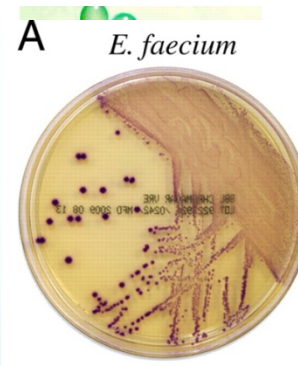
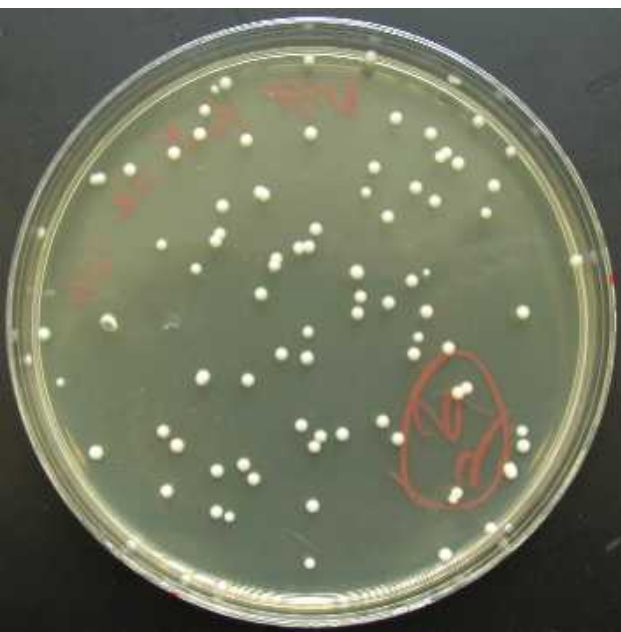
National benchmark

- A tool used in quality management where performance is compared to that achieved by following best practice with the results being used to set standards and as the basis for quality improvement
- PEAT scores Patient Environment Action Team (result published annually)
- National specification scores
- Trends in infections rates (MRSA, C.difficile...)
- Within 3 weeks of publication of scores the worst performing trusts will produce an action plan, re-inspection by PEAT within 6 weeks



Microbiological sampling

- Indicator organism (MRSA, VRE, MRAB, MRPA or *C. difficile*) Vs colony count
- No uniform method
Pre-moistened swab +/- broth enrichment
dip slide +/- neutralizer
different medium
- Indicator organism $< 1 / \text{cm}^2$
- Aerobic colony count (ACC)
 $2.5 \text{ cfu} / \text{cm}^2$



Microbiological sampling

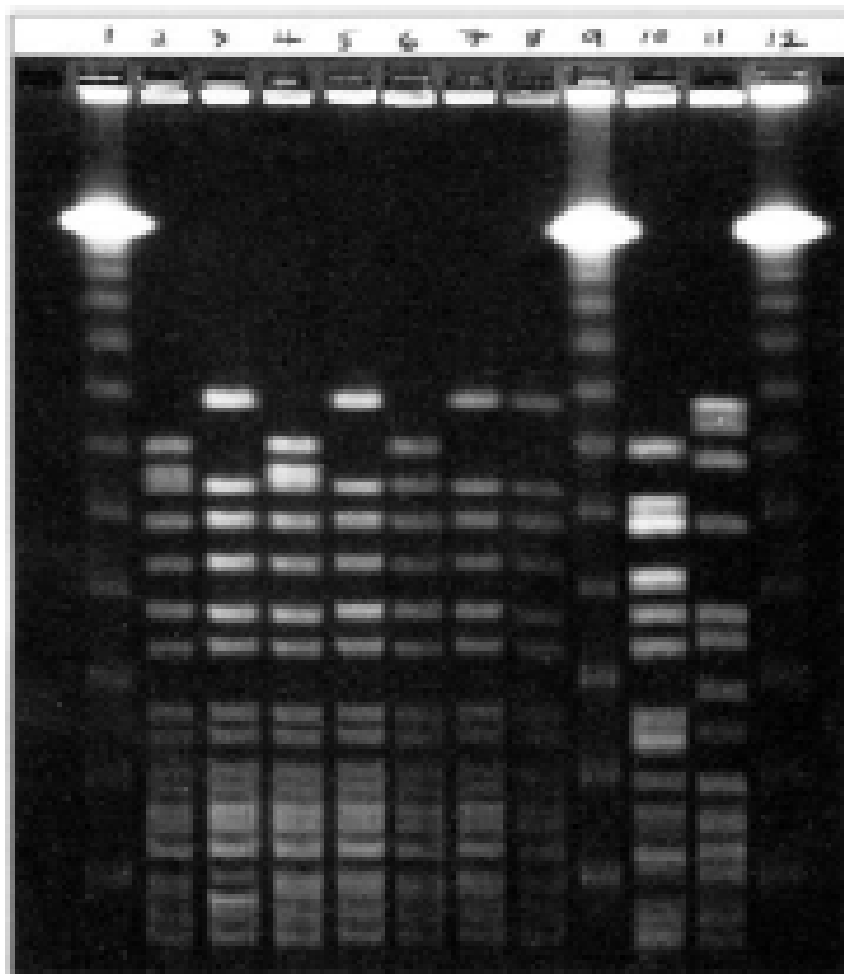


FIGURE 2. Results of pulsed-field gel electrophoresis for vancomycin-resistant *Enterococcus faecium* isolates associated with the study patient. Lanes 1, 9, and 12 show the molecular-size standards (Lambda ladder); lanes 2, 3, and 4 show stool isolates; lanes 5 and 6 show bed rail isolates; lane 7 shows an isolate from a cardiac monitor; lane 8 shows a gloved hand imprint isolate; and lanes 10 and 11 show strains obtained from other patients.

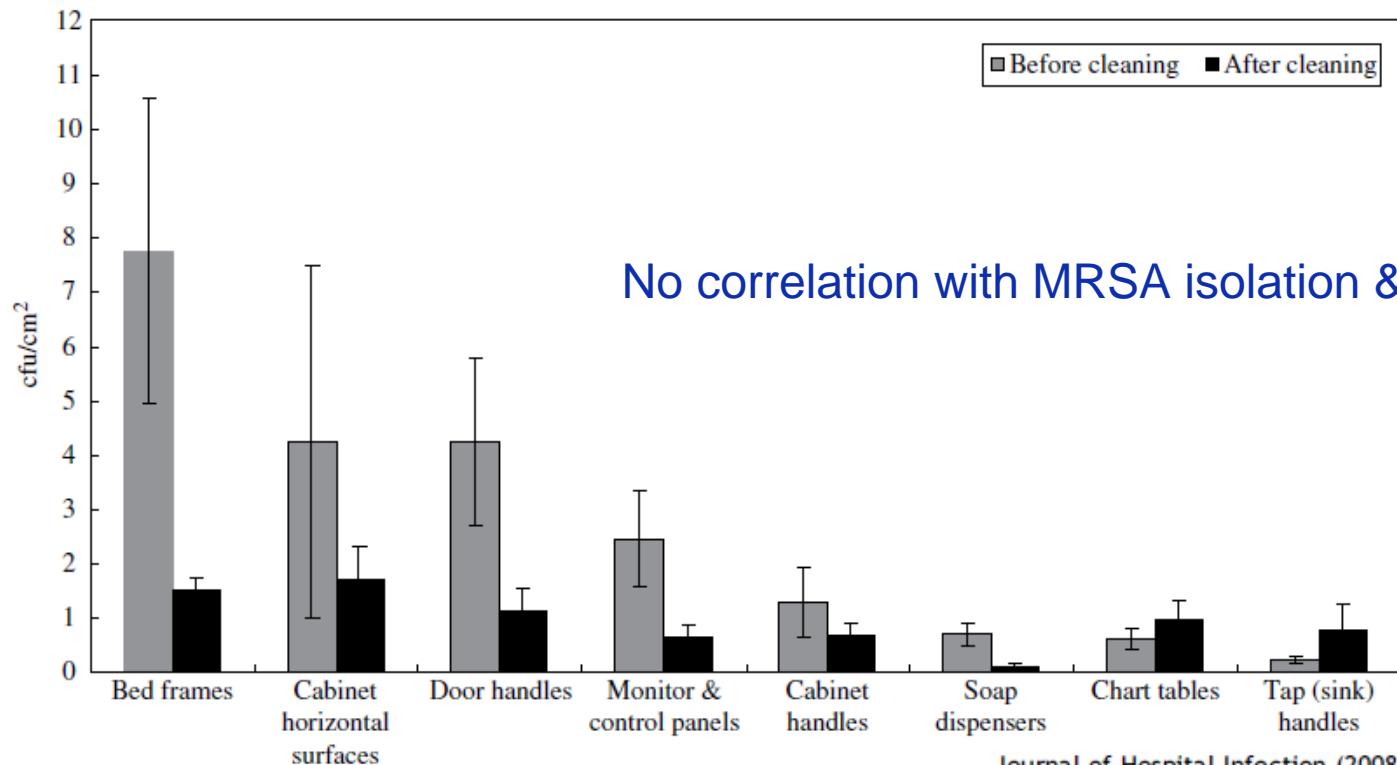
- Labor intensive
- Requires ≥ 48 hrs for result
- Useful for outbreak investigation using typing

Ray AJ *et al.* ICHE 2002



Microbiological sampling

- Wipe rinse (Brain heart infusion and vortex -> MSA)
- Dip slide (TTC red spot medium)
Aerobic colony count



Journal of Hospital Infection (2008) 70, 328–334

Figure 1 Overall cfu/cm² ± SE from frequent-touch surfaces from clinical areas with cleaning policy.



ATP bioluminescence swabbing

- First used in food production premises
- All living cells -> organic matter (bacterial 33%, human secretions/excretion, food)
- One photon of light represents one ATP molecule
- Cut off 250 RLU / 500 RLU
- Correlate with aerobic colony count
- Indicator organisms can present in ATP negative areas
- Quaternary ammonium, iodine cleaner-disinfectant, acid sanitisers and chlorinated alkaline cleaner may affect result; high concentrations of bleach can quench the ATP bioluminescence reaction
- Increase in enthusiasm & attentiveness of trainees
- Consistent sampling points over time
- Expensive

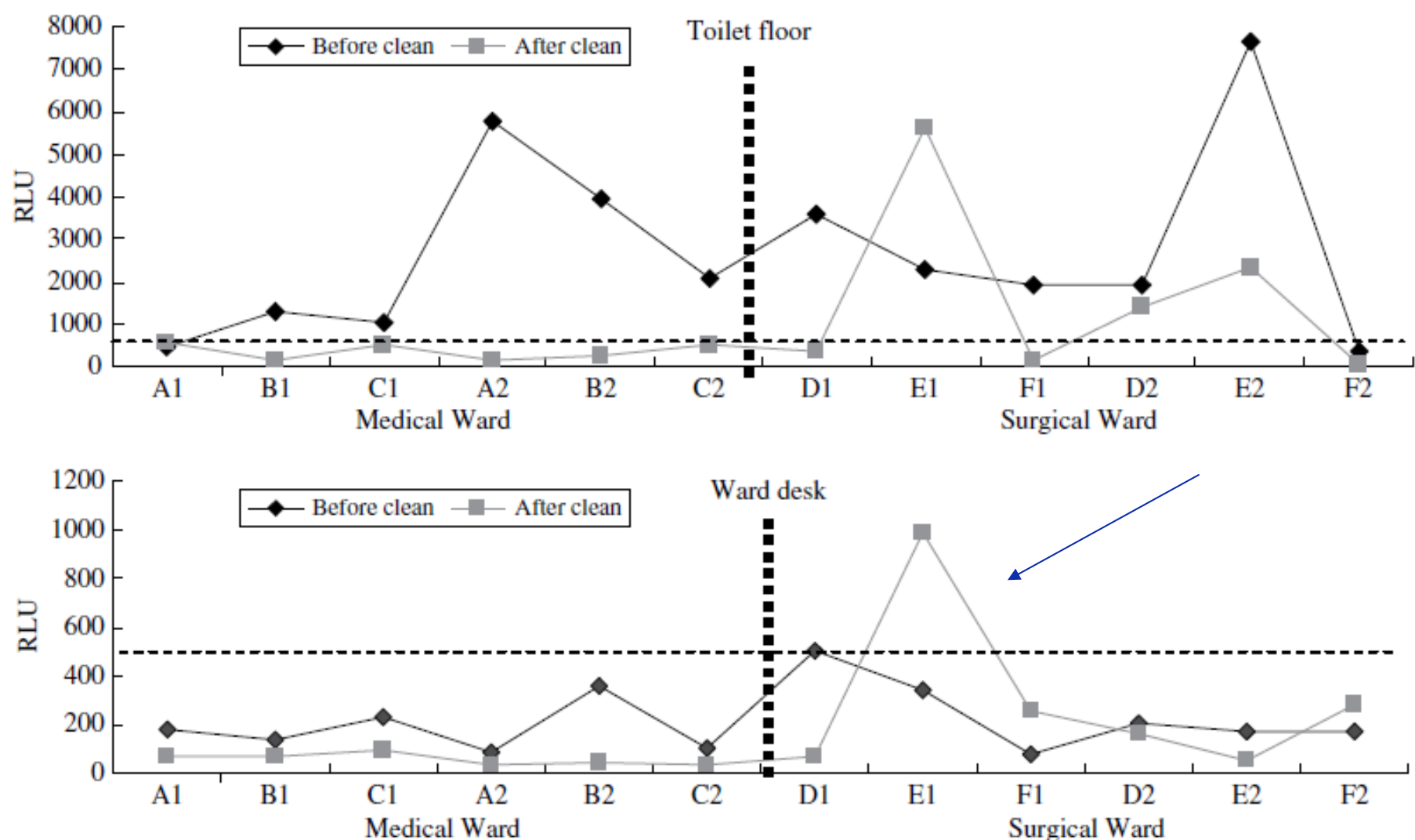
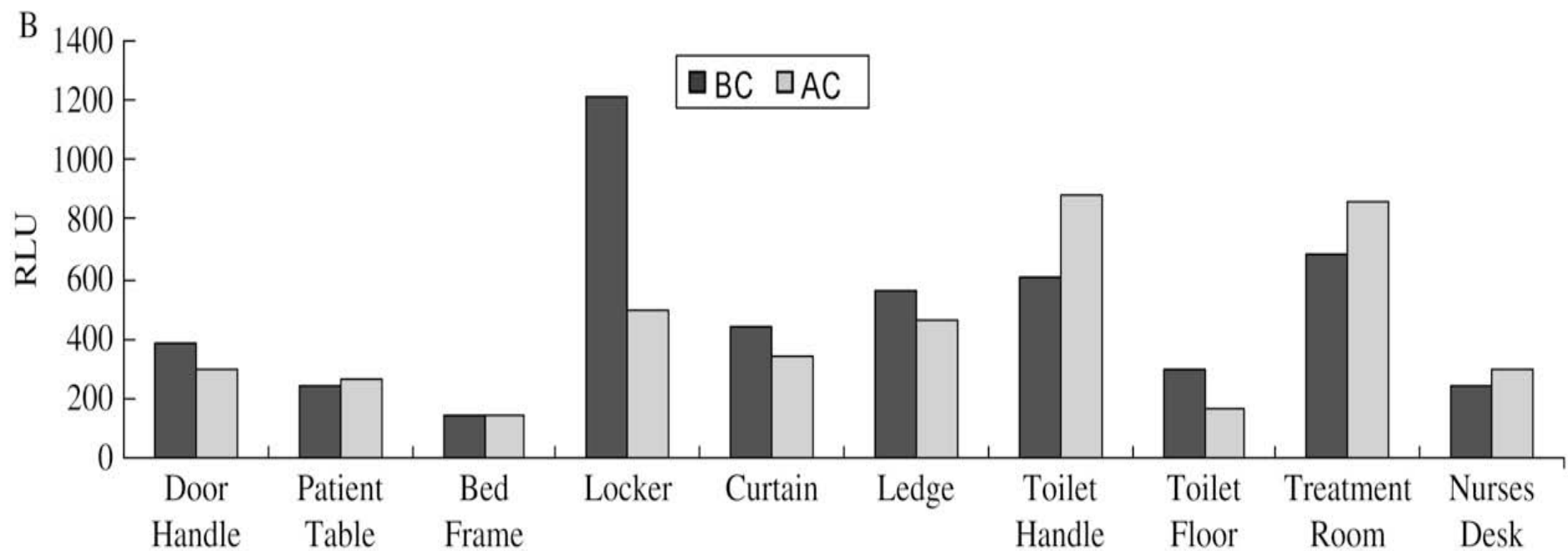


Figure 2 ATP trace, before and after cleaning, on two wards. A1, A2; B1, B2; C1, C2; corresponds to room A, B, C of the medical ward. 1 and 2 designate week 1 and 2 respectively. The same applies to D1–F2, but on the surgical ward. RLU: relative light units; -: 500 RLU pass/fail line. Vertical dotted line represents the division of the medical and surgical ward data. Diamonds: before clean; squares: after clean.



- MRSA 4.5% surface tested
- ACC 6.6-9.1% failed (>50% no growth)
- ATP 49.6% failed

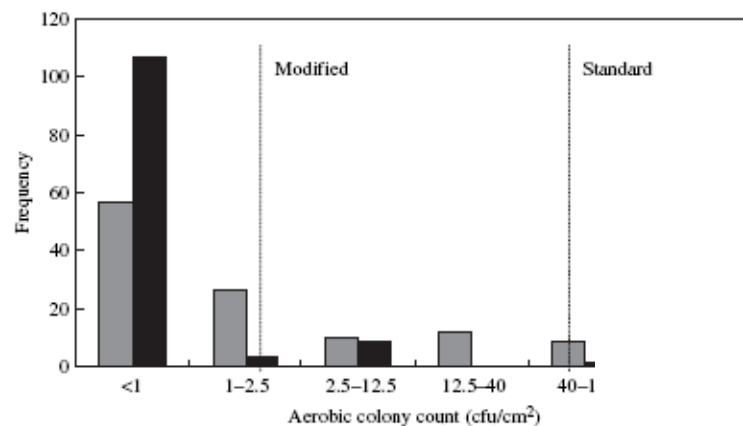


Figure 2 Histogram showing frequency distribution of aerobic colony count after modified (black) protocol cleaning. Six sites on three wards were analysed 10 min after cleaning. Lines show standards that could be achieved 95% of the time with either modified or standard protocols.

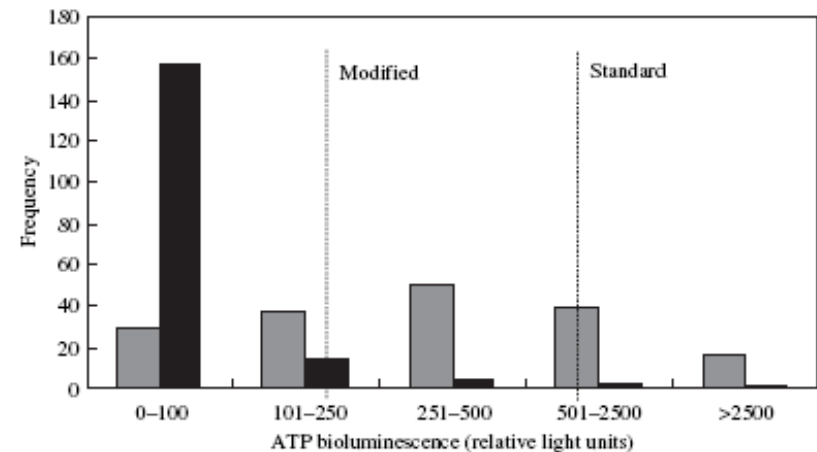


Figure 1 Distribution of ATP bioluminescence values from all sites after standard (grey bars) or modified protocol (black bars) cleaning. Six sites on three wards were analysed 10 min after cleaning on 10 consecutive weekdays. Dotted lines show standards that could be achieved 95% of the time with either modified or standard protocols.

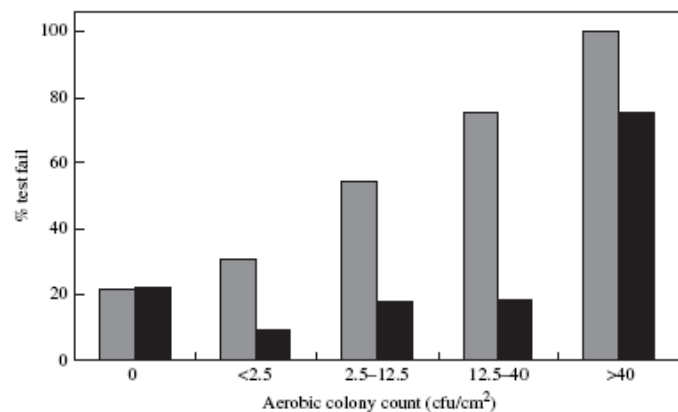


Figure 4 Relationship between the aerobic colony count (ACC) from a surface and its pass or fail using either ATP assessment (grey bars; fail if >250 relative light units) or visual assessment (black bars; see Methods). Graph shows percentage of fails by either form of assessment for each range of ACC isolated.

Figure 1 Correlation between ATP bioluminescence result (expressed in RLU/swab) and Aerobic Colony Count (cfu/swab)

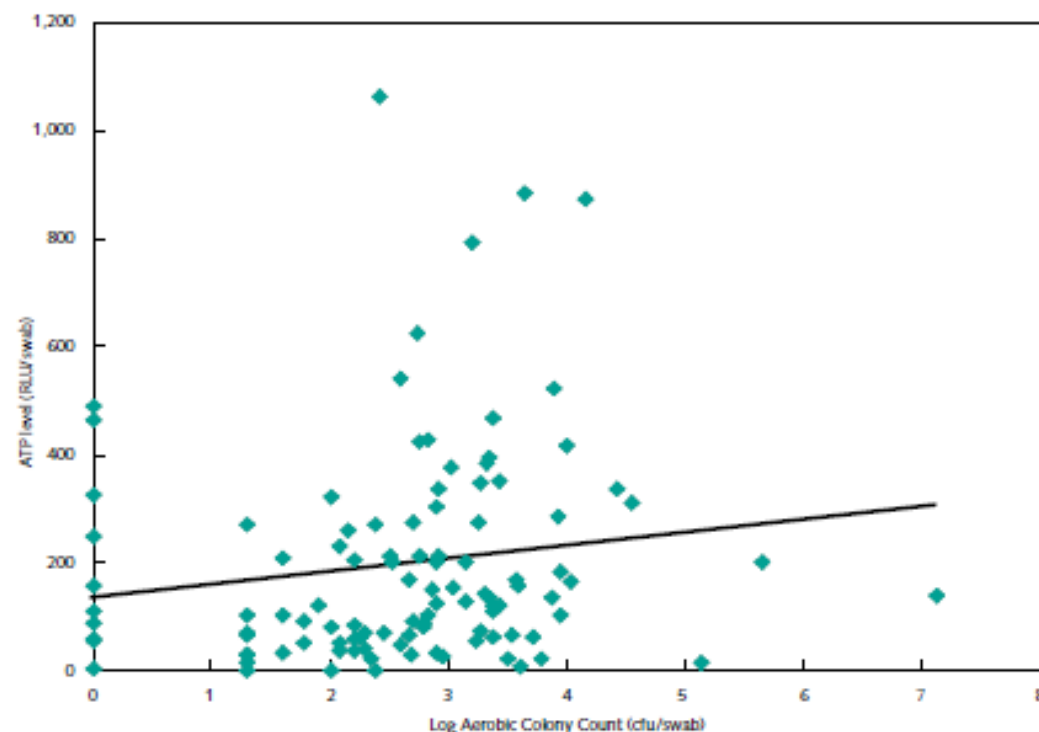


Figure 2 Percentage of sampling sites giving “failures” (ie intermediate or unsatisfactory results) by visual inspection (■), microbiological swabbing (□) or ATP bioluminescence testing (■)

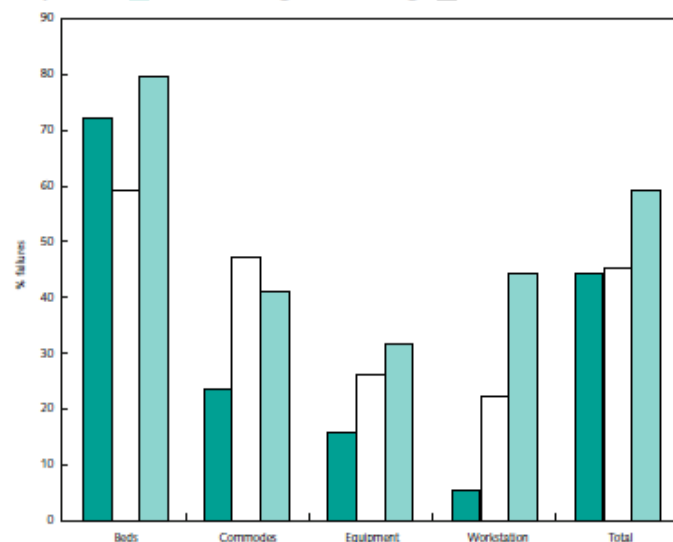


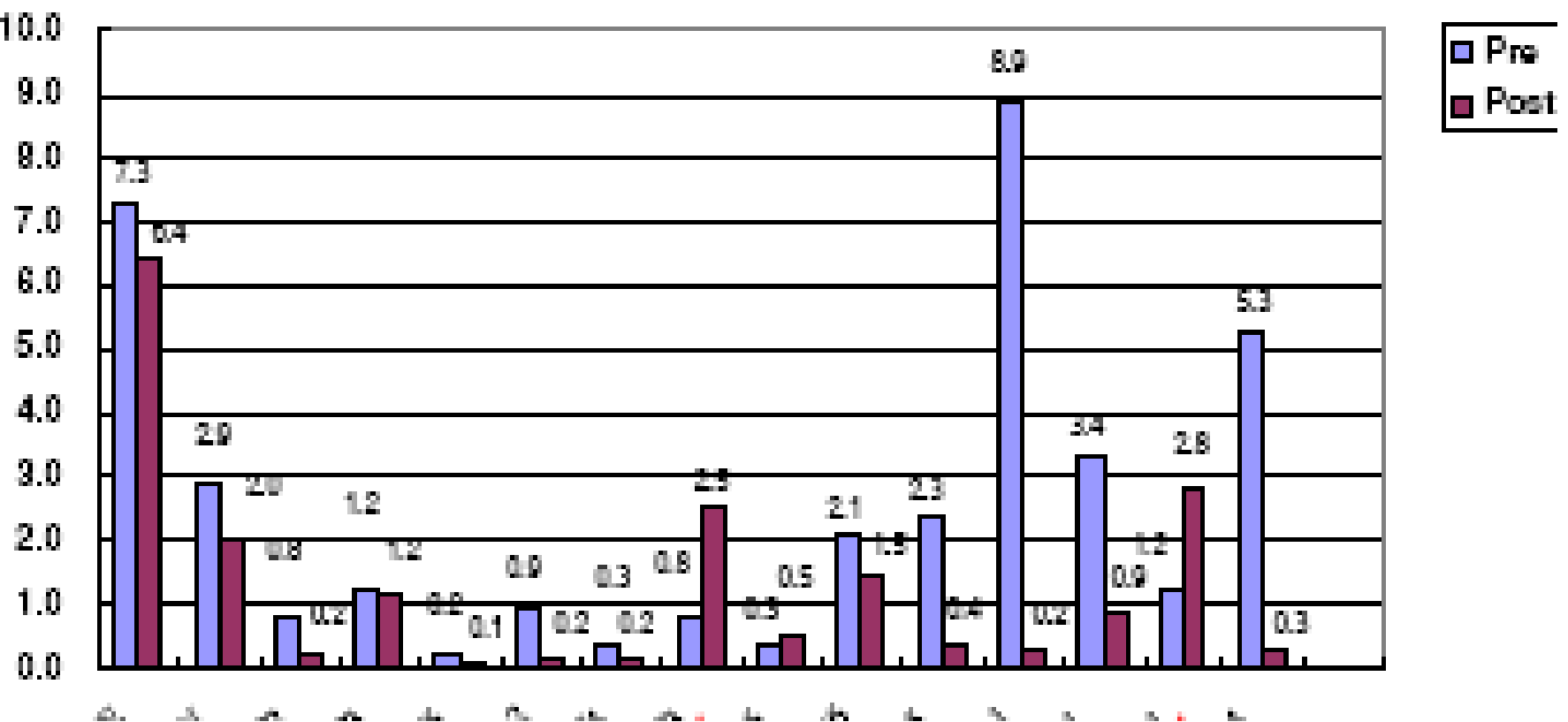
Table 1 Comparison of ATP bioluminescence swabs and microbiological swabs (Aerobic Colony Count) at different hospital sites

	Mean ATP level (and range) (RLU/swab)	Mean Log ₁₀ Aerobic Colony Count (and range) per swab
Under beds	269 (14–1,065)	2.94 (0–7.12)
Commode seats	127 (0–429)	2.55 (0–5.64)
Patient equipment	70 (1–207)	2.07 (0–4.03)
Nurses' workstations	164 (32–873)	2.20 (0–4.16)

Of all the sites sampled, 18% were deemed to be unsatisfactory by visual inspection for cleanliness, and a further 26% were of an intermediate quality (Figure 2); in comparison, 45% of sites gave unsatisfactory microbiology results, whilst the ATP method gave 22%



ATP study in PMH







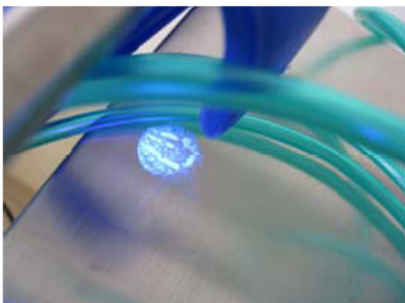
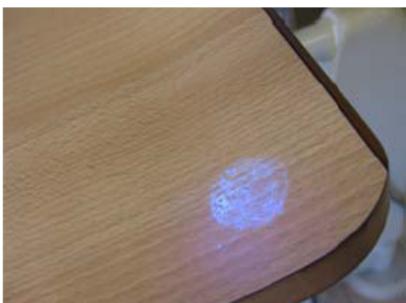
Patient locker



Fluorescent marker

- Viscous translucent solution remains stable for weeks
- Can be completely removed by wiping with a damp cloth for 5 s using light finger pressure
- 33% of toilet samples with no visible residual fluorescent marker were still contaminated with *C. difficile*
- Monitor cleaning practice rather than cleanliness



Site of spot check	Uncleaned surfaces still stained by fluorescence	Site of spot check	Cleaned surfaces showed no fluorescence
Bed end		Bedside rail	
Bedside trolley drawer		Remote control (Bed 2)	
Bedside trolley surface		<ol style="list-style-type: none"> 1. Gel remains with no evidence of removal 2. Gel partially remains with evidence of attempted removal 3. Gel has been completely removed 	
Bedside table			



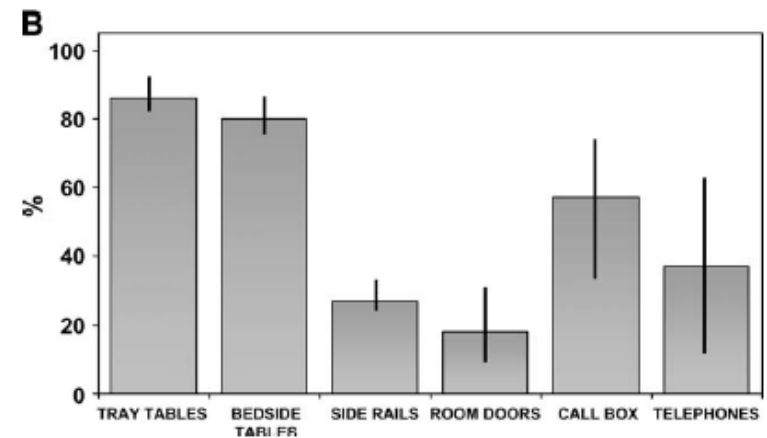
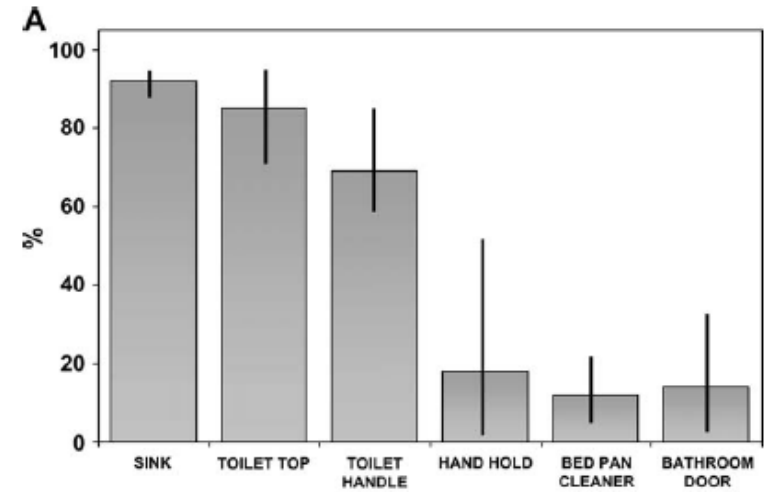
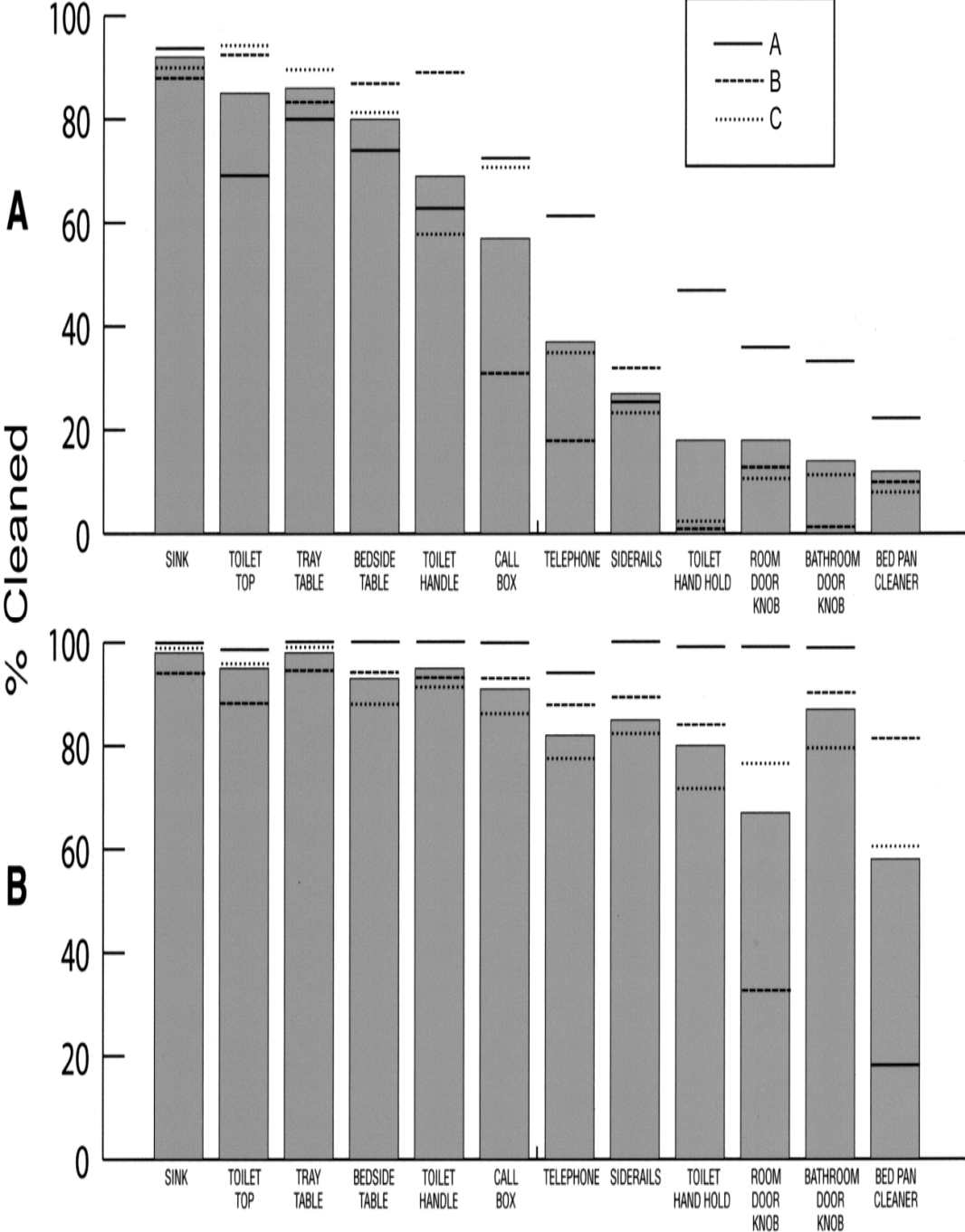


Fig 3. The proportion (%) of targets cleaned in (A) bathroom areas and (B) patient rooms. The columns represent the mean for the three hospitals. The vertical bars represent the range of cleaning observed.

Evaluating Patient Zone Environmental Hygiene

Method	Ease of Use	Identifies Pathogens	Useful for Individual Teaching	Directly Evaluates Cleaning	Published Use in Programmatic Improvement
Covert Practice Observation	Low	No	Yes	Yes	1 Hospital ¹¹
Swab cultures	High	Yes	Not Studied	Potentially	1 Hospital ⁵⁰
Agar slide cultures	Good	Limited	Not Studied	Potentially	1 Hospital ⁵⁸
Fluorescent gel	High	No	Yes	Yes	49 Hospitals ^{22,28,31,33}
ATP system	High	No	Yes	Potentially	2 Hospitals ^{20,74}

Fig 4. Summary of the 5 methods used in evaluating environmental hygiene



APIC guide to the elimination of MDR Ab transmission in healthcare settings 2010

Outbreak situation -

- **Monitor cleaning performance by ... observation +/- use of fluorescent staining. (consider ATP bioluminescence assay as a means to monitor cleaning effectiveness.)**
- **Perform environmental cultures if the environment is implicated in transmission of the MDR Ab.**

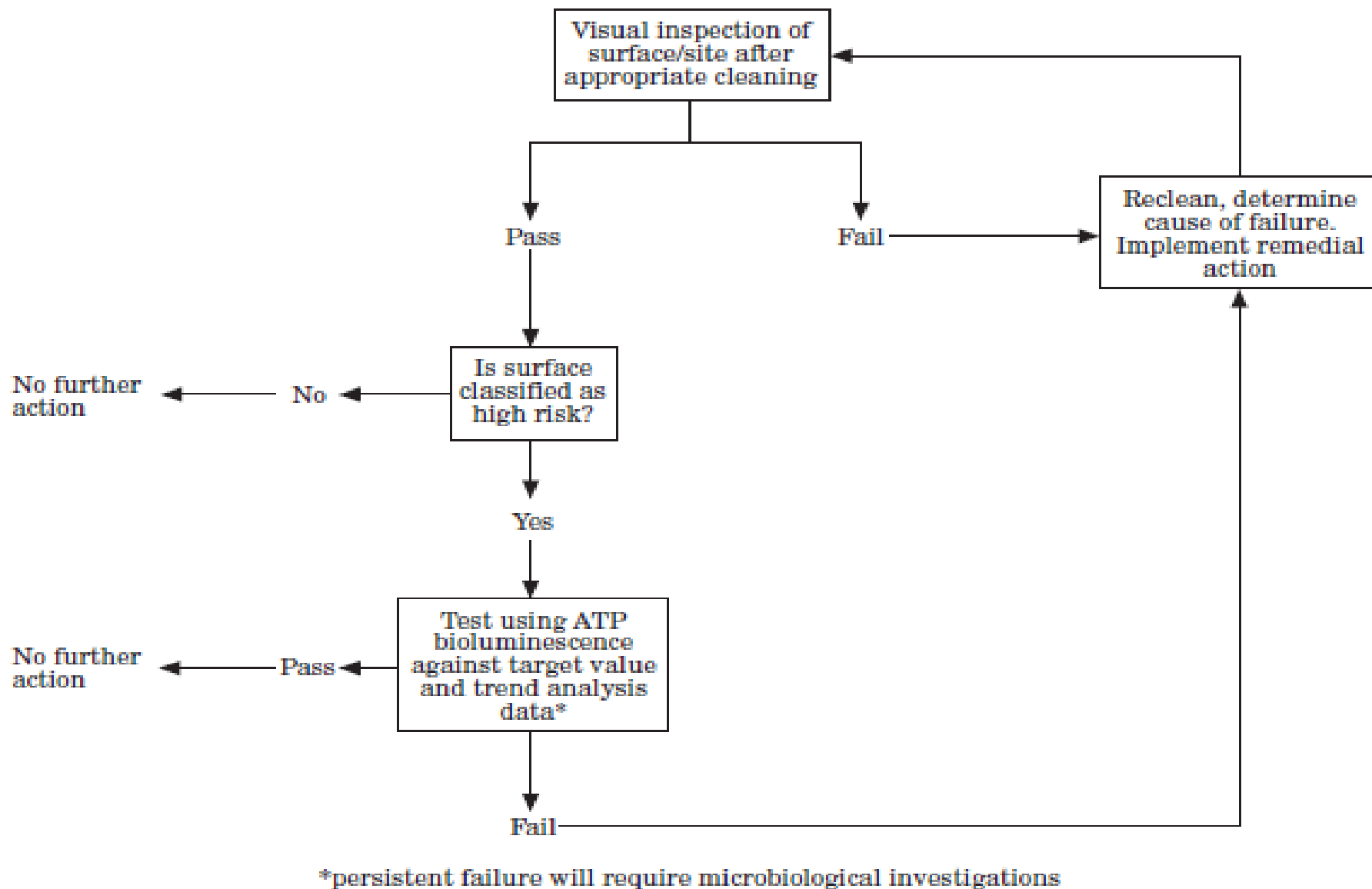


Figure 1 Stages in an integrated cleaning monitoring programme.



Deep clean

- Concentrated programme of activity over and above routine and ad-hoc cleaning activities undertaken on a day to day basis



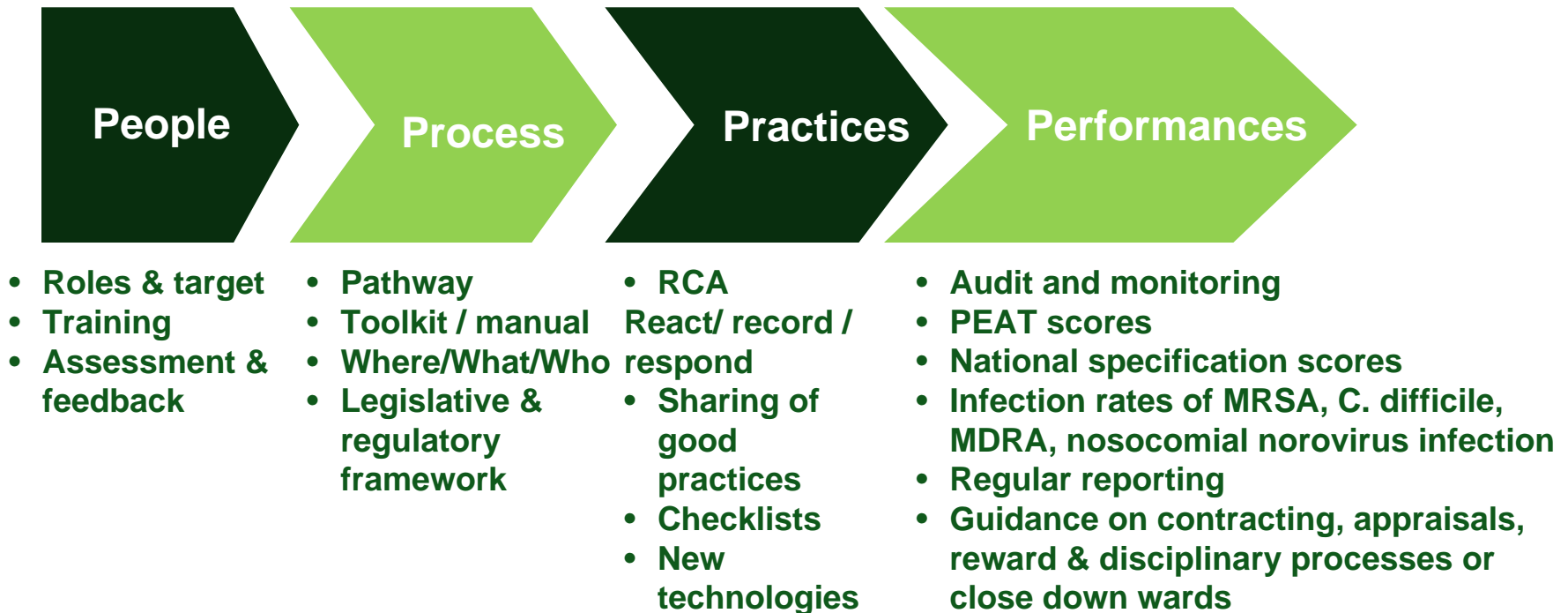
Enhanced Program of environmental cleaning




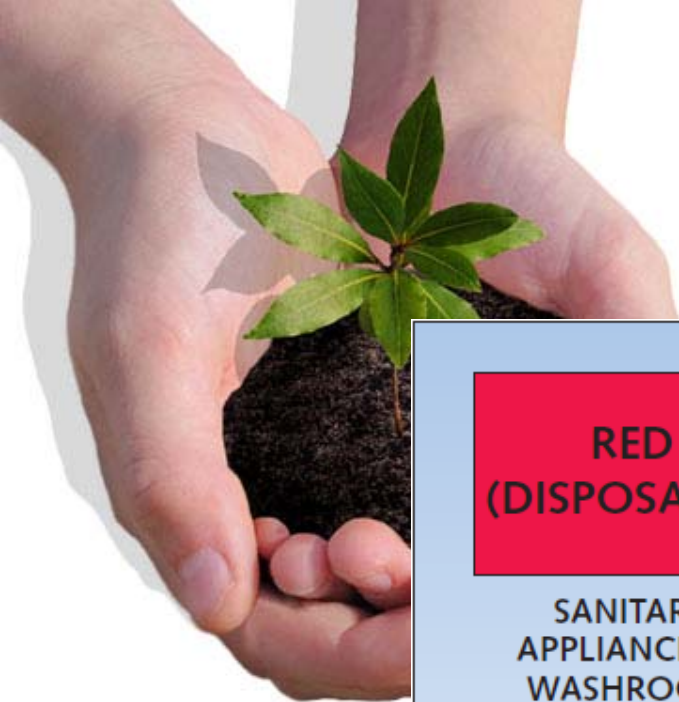
Approaches to Programmatic Environmental Cleaning Monitoring

Conventional Program	Enhanced Program
<ul style="list-style-type: none"> • Subjective visual assessment • Deficiency oriented • Episodic evaluation • Problem detection feedback • Open definition of correctable interventions 	<ul style="list-style-type: none"> • Objective quantitative assessment • Performance oriented • Ongoing cyclic monitoring • Objective performance feedback • Goal oriented structured Process Improvement model

Fig 2. A comparison of the elements of conventional hygienic monitoring with enhanced programs.



Potential problems	Strategies
Inadequate manpower	Full deep clean one ward per month
Clear policy	Bare below elbows
	Patient involvement (survey, public cleaning schedule, housekeeper forums, comment books)
Use one cloth to clean all area	Microfiber or disposable cloth, color coding
Poor compliance	Withhold payment for poor cleaning services



Colour Code



**RED
(DISPOSABLE)**

**SANITARY
APPLIANCES &
WASHROOM
FLOOR**



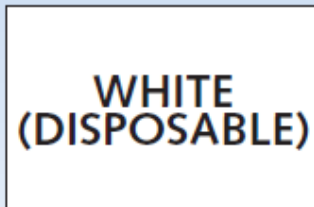
BLUE

**GENERAL AREAS
(inc. wards, depts, office
& Communication areas)**



GREEN

**KITCHENS
(dept & ward)**



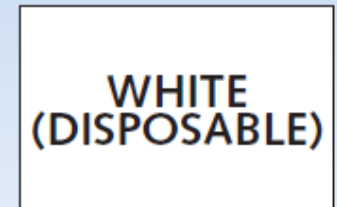
**WHITE
(DISPOSABLE)**

**ISOLATION
ROOMS**



YELLOW

**WASHBASINS
& WASHROOM
SURFACES**



**WHITE
(DISPOSABLE)**

**OPERATING
THEATRES &
ANTE ROOMS**


**THE GOLDEN RULE: WORK FROM THE CLEANEST AREA
TOWARD THE DIRTIEST AREA. THIS GREATLY REDUCES THE
RISK OF CROSS CONTAMINATION.**



SECTION 5.0

Cleaning Method Statements

FLOOR CLEANING	45
HARD AND SEMI-HARD FLOORS.....	45
<i>a) Dust Controlling.....</i>	<i>45</i>
<i>b) Mopping.....</i>	<i>47</i>
Damp Mopping (single bucket/single solution)	47
Damp Mopping (double bucket/double solution)	50
Damp Mopping (spot)	53
Flat Mopping.....	55
<i>c) Spray Cleaning.....</i>	<i>58</i>
<i>d) Ultra High Speed Buffing/Burnishing</i>	<i>62</i>
<i>e) Floor Scrubbing.....</i>	<i>66</i>
<i>f) Automatic Scrubber Drying.....</i>	<i>70</i>
<i>g) Floor Stripping.....</i>	<i>74</i>
<i>h) Applying Polish.....</i>	<i>78</i>
<i>i) Sealing</i>	<i>81</i>
<i>j) Stains</i>	<i>84</i>
<i>k) Suction Cleaning.....</i>	<i>88</i>
<i>l) Water Extraction.....</i>	<i>91</i>
SOFT FLOORS.....	94
<i>m) Carpet Shampoo</i>	<i>94</i>

Potential problems	Strategies
<p>Wrong concentration of disinfectants</p>	<p>Dual function hypochlorite cleaner/disinfectants (1000ppm)</p>
	<p>Dual function chlorine dioxide-based cleaner/disinfectants (125ppm)</p>
<p>Difficult to clean areas</p>	<p>Portable ozone sanitiser Steam cleaning / HPV</p>
<p>Inadequate terminal cleansing</p>	<p>Automated bed washers</p>



The End.

Q&A?