

ENVIRONMENTAL HYGIENE

technology review



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***“Environmental Services
Community of Practice”***

IPAC Eastern Ontario
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Kingston, ON

Disclaimers & Caveats

I am not a certified Infection Control Professional

I am not a certified Financial Professional

I am an environmental hygiene Operations Professional

I make my living consulting for healthcare organizations and hygiene technology providers, across North America, to improve patient safety and financial performance through improvements in clinical environmental hygiene.

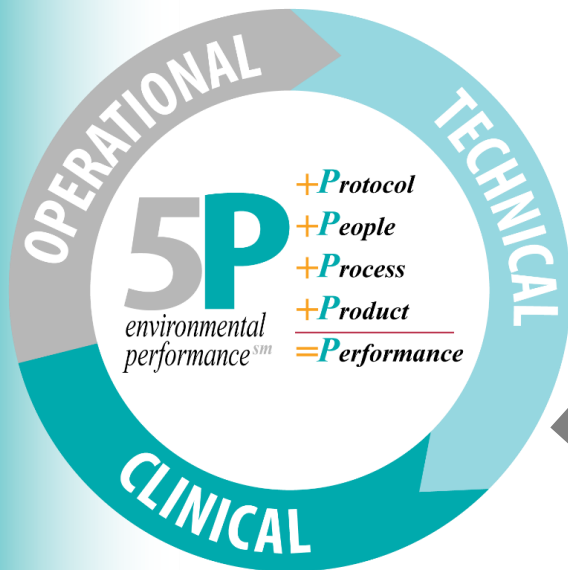
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Environmental Hygiene Performance FrameworkSM



CLINICAL = Medical, Clinical, Infection Prevention & Control

TECHNICAL = Hygiene Supply & Technology Industries

OPERATIONAL = Environmental Services, Supply Chain, Finance



Protocol: (the science of cleaning and disinfection) integrated clinical, professional & technical, evidence-based, practice guidance

People: (motivated and independent thinking workforce) competent & engaged human resources, organized and aligned to patient-safety

Process: (scalable & replicable output) consistent execution of standard work, effectively integrated with clinical practice

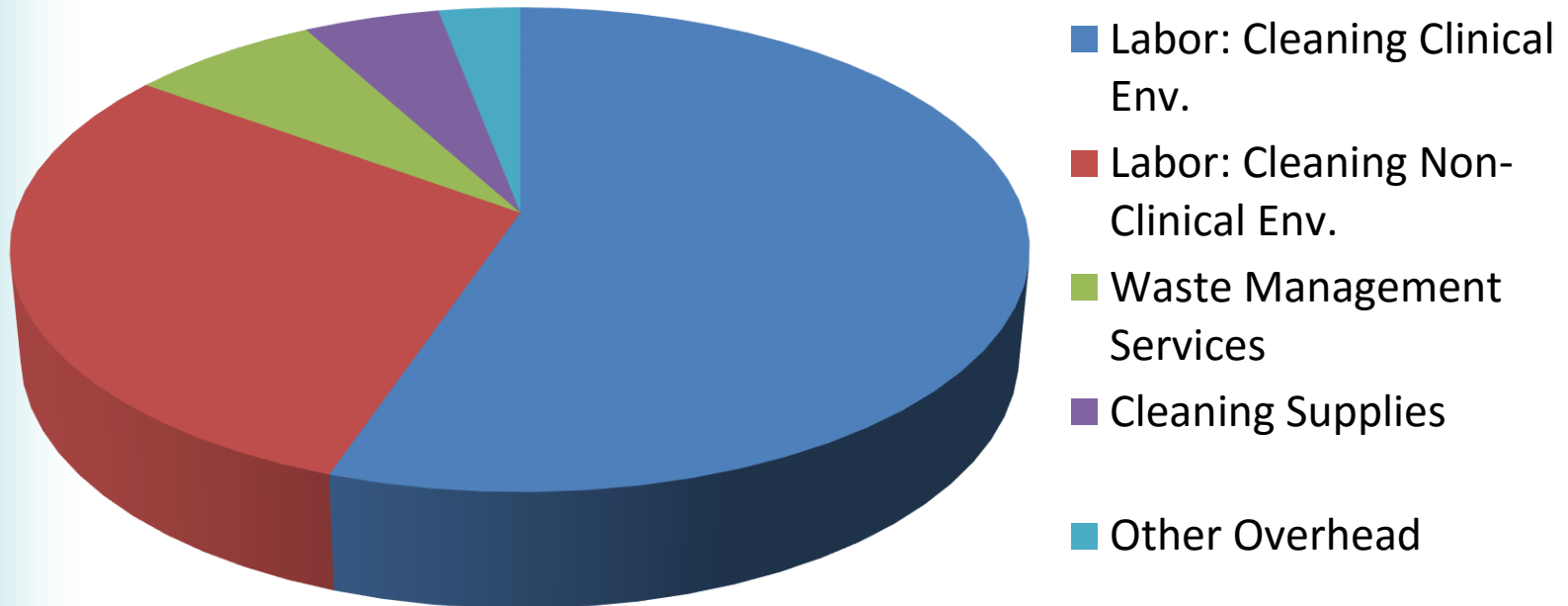
Product: (products, equipment, systems) strategic & effective utilization of hygiene technology enablers

Performance: (what “good” looks like) continuous improvement informed by measurable key performance indicators

Environmental Services

where does the money go?

Average Cost Allocation



Environmental Hygiene Technology Landscape



Environmental Hygiene Technology Assessment Framework



1. Does It Work?

- 1.1 Objective, Peer-Reviewed, Performance Research (i.e. log reductions)
- 1.2 Supported by Protocols, Processes guidance etc.

2. Will It Make A Difference?

- 2.1 Evidence-Based Clinical and/or Quality (positive) Impact
- 2.2 Return on Investment (ROI)

3. Is It a Solution?

- 3.1 (ES) Management Acceptance
 - 3.1.1. In-Use Cost (Product / Labor)
 - 3.1.2. Start Up Costs (Dispensers, Training etc.)
 - 3.1.3. Ease of Purchase
 - 3.1.4. Safety/Regulatory Approval
- 3.2 Clinical (ICP) Acceptance
 - 3.2.1. Clear & Compelling Evidence
 - 3.2.2. Attributable Clinical Benefit
 - 3.2.3. Consistent & Sustainable Execution
- 3.3 Worker Acceptance
 - 3.3.1. Performance
 - 3.3.2. Odor / Reactivity / Safety
 - 3.3.3. Ease of Use
- 3.4 Customer (Internal / Patient / Visitor) Acceptance
 - 3.4.1. Impact on Surfaces / Equipment / Operational & Clinical Processes
 - 3.4.2. Noticeable Odor / Film / Residue
 - 3.4.3. Brand or Process Inspire Patient / Visitor Confidence



The Technology Hype Cycle; 2013; GARTNER

Chemical-Based Surface Disinfectants & Disposable Wipes

What:

- Traditional providers changing technology spectrum
- Upstart companies entering the market

So What:

- Increasingly narrow band of differentiating features
- Industry marketing hype & product literature is confusing

The Big Deal:

- ICPs are becoming confused by the (active ingredient) nuances; less inclined to intervene with supply chain & environmental services
- Focus on green products that disinfect – limited choices for registered disinfectants, however this will change

Ones to Watch:

- Stabilized Aqueous Ozone
- Hydrogen Peroxide & Blended Chemistries



UVD / Fogging / Misting Machines

What:

- Use of the “robot-like devices” to reset the microbial load on surfaces at the point of terminal clean

So What:

- Strong marketing & technology appeal (the hospital is “seen” to be doing the right thing)
- Positioned as “fool proof” technology, consistent, reliable (vs. human error – 40% surfaces never wiped)

The Big Deal:

- Hospital cleaning doesn’t require a premium performing disinfectant; allows Quats to remain
- Not the solution for everyone/everywhere, but is something “innovative” so will get attention (see: the technology hype cycle) **\$ 60K - \$ 150K**

Ones to Watch:

- Portable Disinfection Systems,
- Fixed-Mounted UVD Systems

Secondary
Disinfection



Coatings, Infusions, Surface Repair and Treatments

What:

- New generation of patient furniture, cubicle drapes, paints, after-market surface treatments, such as: copper, silver, nickel, anti-microbial agents
- Self-disinfecting surfaces can be created by impregnating or coating surfaces with heavy metals (e.g. silver or copper), germicides (e.g., triclosan), or miscellaneous methods (e.g., light-activated antimicrobials).

So What:

- Positioned as “added assurance” technology, consistent, reliable (vs. human error – 40% surfaces never wiped)
- Innovative “ecologically sustainable” approach to environmental hygiene vs. (harmful) chemicals

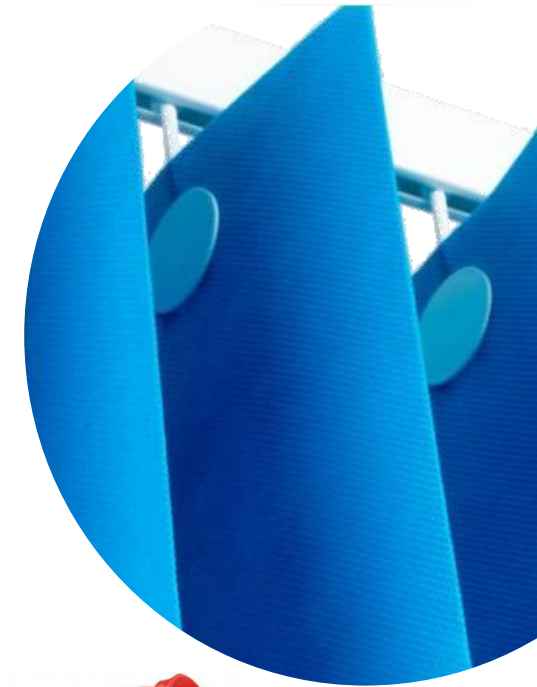
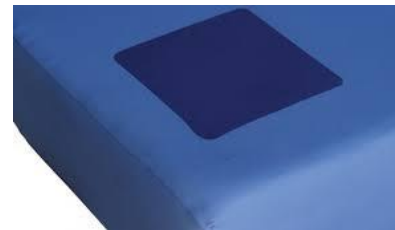
The Big Deal:

- Will be marketed as a strong (premium) differentiator at the time of purchase; off-set by reduced need/cost for cleaning
- Analogy: no-finish flooring substrates

Ones to Watch:

- Nickel-Copper blend surface treatments
- After-market surface regenerators

Surface
Renewal &
Regeneration



Environmental Monitoring

Environmental Monitoring

What:

- Environmental Sampling, ATP, Microbial Simulations, Visual Monitoring systems and technologies
- Performed post-cleaning (with lag time) by someone other than environmental services

So What:

- Lagging, non-standard indicators, with no correlation to clinical outcomes
- Inconsistent with LEAN (stop-the-line?), Positive Deviance (outcomes?)
- ATP is seen as innovative and is being hyped and touted as “best-of-the-lot” solution, however is fallible & costly, therefore adoption will not become mainstream

The Big Deal:

- ICP community requires a mechanism to ensure cleaning and disinfection is working that is objective, empirical, standardized and informed by evidence
- No ability to separate product efficacy from human performance
- Product satisfaction is tied to a weak evaluation process (with compatibility challenges)

Ones to Watch:

- Nano-based continuous assessment technology
- New generation florescent marking agents
- Integrated, WEB, technology platforms



Important Trends & Implications

Trends

Increased HAI Public Awareness & Provider Urgency to Act

Financial Reform, Revenue & Cost Containment Challenges

Proliferation of Environmental Hygiene Technology Options

Acceptance that Human Processes are Fallible

Increased involvement by Infection Preventionist in the management of Environmental Services

More public HAI disclosure; stronger financial pressure to improve performance; increased hunt for the IPAC magic-bullet; Snr. leaders will seize control of the HAI agenda

Hospital utilization rates will increase, as will use of out-patient clinical facilities; outsourcing of ES will remain a viable option, although product control will not shift; patient throughput and satisfaction will remain priorities

Innovations will proliferate; major players will compete with upstarts; having a product in multiple locations on the hype-cycle will matter

Interest in technology solutions or workarounds will grow; risk that healthcare leaders will "give-up" on traditional human-based solutions; patient attitudes will be critical

ICPs will assume a greater role in oversight of the EH program; evidence-based practice will be a priority; focus on stronger front-line hourly ES worker education and individual accountability

Implications

Menu of Potential Environmental Hygiene Performance Improvement Solutions

Cleaning & Disinfection

1. Launch a microfibre cleaning system
2. Change disinfectant or disposable wipes product
3. Clarify cleaning & disinfections responsibilities
4. enhance training for ES/Clinical employees
5. **Add more staff to increase cleaning frequencies**

Restorative Interventions

1. Purchase/resource a UV-C based portable room disinfecting system
2. Purchase/resource an Ozone-based portable room disinfecting system
3. Purchase/resource a Hydrogen-peroxide vapor based portable room disinfecting system

Surface Renewals & Regeneration

1. Repair, replace or treat existing surfaces to make them respond better to cleaning and disinfection
2. Replace privacy drapes or upholstered fabrics with silver infused products
3. Upgrade patient bed-rails or bedside furniture to nickel-copper coated products

Environmental Monitoring

1. Implement a visual cleanliness monitoring system
2. Implement a florescent marking system
3. **Add more supervision to better monitor staff**

Environmental Infection Prevention

Reality Check

Clinical

- Ever-changing biological conditions
- Contradictory technical advice
- Cause of HAI's are multi-factorial
- ICP knowledge and interest in environmental hygiene is highly variable

Operational

- ES & ICP band width for assessment is low
- Both ES & ICP suffer from a lack of resources
- Lack of financial resources; yet poor ability to calculate a return-on-investment
- Variation in environments
- Disruptive impact of supply chain channels

Variables and Constraints for INFECTION PREVENTION STRATEGY

CLINICAL

epidemiology
medical
clinical



OPERATIONAL

physical
financial
human



The emerging **Value Proposition of Environmental Hygiene**, represents a paradigm shift for the everyone...Are you ready?



"I realize you had an appointment, however the housekeeper has been detained on patient rounds. You'll just have to wait."

Environmental Hygiene Technology Assessment Framework

- Principles
 - Objective
 - Measurable
 - Comparative Benefit
- Components
 - Assessment Pre-conditions
 - People, Process, Environment (Who / How / Where)
 - Specific Objective (Why / What)
 - Clinical Activity (When)
 - Research
 - Vendor Provided Evidence
 - Peer Referrals
 - Professional Research
 - Structured Methodology
 - Process: Time Frame / Comparative
 - Without Internal / External Influences
 - Mitigating Complexities
 - Criteria For Attributable Benefit (Clinical, Financial, Operational)
 - Peer Advisor
 - Analysis
 - Direct & In-Direct Interventions & Support
 - Sustainable Benefit
 - Full Cost / Benefit Disclosure

Industry Literature & Expert Guidance

(Snap Shot Overview)

Review of VHP, UVD, HPM

RESEARCH QUESTIONS

1. What is the clinical effectiveness and safety of non-manual techniques utilizing UV light or hydrogen peroxide for room disinfection in healthcare facilities?
2. What are the evidence-based guidelines for the use of non-manual techniques utilizing UV light or hydrogen peroxide for room disinfection in healthcare facilities?

KEY FINDINGS

Low quality evidence from one systematic review and three cohort studies suggests that VHP is effective in reducing the incidence of nosocomial infections due to a number of different pathogens in hospital settings. In three low quality case studies, VHP decontamination successfully terminated *Acinetobacter baumannii* outbreaks. Low quality evidence from one cohort study suggests that UV light reduces the incidence of hospital-associated *C. difficile* infections. Two evidence-based guidelines included VHP and UV light decontamination in their scope and found that there was insufficient evidence to make recommendations about the use of these methods.

METHODS

Literature Search Strategy

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2014, Issue 3), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to documents published between January 1, 2009 and March 31, 2014.

Rapid Response reports are organized so that the evidence for each research question is presented separately.



TITLE: Non-Manual Techniques for Room Disinfection in Healthcare Facilities: A Review of Clinical Effectiveness and Guidelines

DATE: 30 April 2014

CONTEXT AND POLICY ISSUES

Contaminated surfaces in healthcare facilities may contribute to the transmission of pathogens implicated in nosocomial infections, such as *Clostridium difficile*, methicillin resistant *Staphylococcus aureus* (MRSA), vancomycin resistant *Enterococci* (VRE), gram-negative rods (*Acinetobacter* spp. and *Enterobacteriaceae*) and Norovirus.^{1,2} While patient rooms are regularly cleaned and disinfected using manual techniques, evidence suggests that the adequacy of cleaning is often suboptimal, particularly when the focus is only on those surfaces perceived to be high-risk or frequently contacted (high-touch).¹ As well, when cleaning, sufficient wet contact time between the surface and disinfectant is needed to ensure adequate disinfection, but is not always achieved.¹ Wiping of all surfaces where there is hand contact, not just those that are considered to be high risk or high-touch areas, and ensuring adequate wet contact time is required for adequate disinfection of the patient environment.¹

Inadequate cleaning using manual techniques prompted the development of no-touch systems that can decontaminate objects and surfaces in the patient environment.^{1,2} These technologies employ the use of ultraviolet (UV) light or hydrogen peroxide. There are two systems that use vaporized hydrogen peroxide (VHP) in a dry or wet aerosol and one that uses a hydrogen peroxide mist (HPM), which has a larger particle size.^{1,2} VHP or HPM is produced using a portable generator that quickly increases the concentration of hydrogen peroxide in the room during a decontamination phase which is repeated several times.^{1,2} The process takes approximately two to six hours per room.² The UV light systems emit UV light from portable automated units at a wave-length that is germicidal. The unit is placed in a vacant patient room in the centre and can be piloted with a remote to ensure all surfaces are reached as they must be in the line of site to be decontaminated. The units have sensors which stop the irradiation should the door be opened.² The process of decontamination takes approximately 45 minutes. One application of these cleaning systems is in terminal or discharge decontamination of vacated patient rooms. They supplement, but do not replace manual cleaning of patient rooms, as surfaces must first be free of dirt and debris prior to their use. Vaporized hydrogen peroxide and UV light systems provide a higher level disinfection or decontamination of all exposed surfaces and equipment in patient rooms, and are not a standalone means of cleaning.^{1,2}

Inclusions: The Rapid Response Service is an information service for those involved in planning and providing health care in Canada. Rapid responses are based on a limited literature search and are not comprehensive, systematic reviews. The intent is to provide a list of sources and a summary of the best evidence on the topic that CADTH could identify using all reasonable efforts within the time allowed. Rapid responses should be considered along with other types of information and health care considerations. The information included in this response is not intended to replace professional medical advice, nor should it be construed as a recommendation for or against the use of a particular health technology. Readers are also cautioned that a lack of good quality evidence does not necessarily mean a lack of effectiveness particularly in the case of new and emerging health technologies, for which little information can be found, but which may in future prove to be effective. While CADTH has taken care in the preparation of the report to ensure that its contents are accurate, complete and up to date, CADTH does not make any guarantee to that effect. CADTH is not liable for any loss or damages resulting from use of the information in the report.

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No Touch Room Disinfection Systems

FRASER HEALTH INFECTION PREVENTION AND CONTROL

Review of No-Touch Room Disinfection Systems

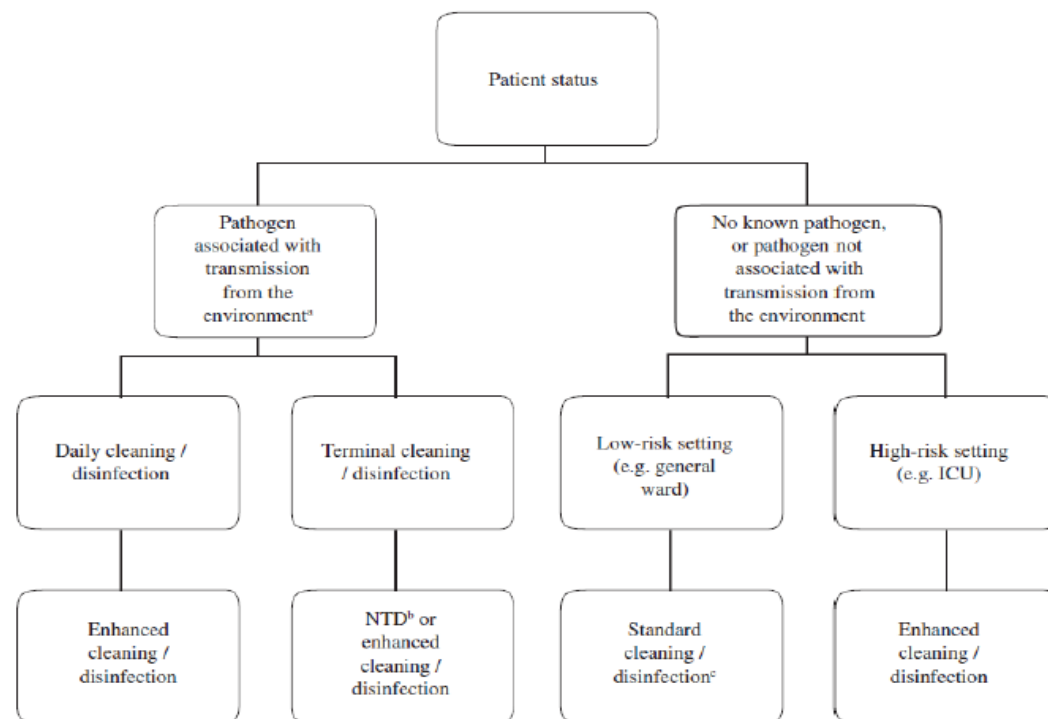
Report

Prepared
by

Fatma Taha & Fuad Ibrahimov

IPC Consultants

10/12/2014



AD Russell Memorial Teleclass
**Does Improving Surface Cleaning and Disinfection
Reduce Healthcare-Associated Infections?**

William A. Rutala, PhD, MPH

Director, Hospital Epidemiology, Occupational Health and Safety;
Professor of Medicine and Director, Statewide Program for Infection
Control and Epidemiology

University of North Carolina at Chapel Hill and UNC Health Care,
Chapel Hill, NC

Hosted by Prof. Jean-Yves Maillard
Cardiff University, Wales

ALL “TOUCHABLE” (HAND CONTACT) SURFACES SHOULD BE WIPED WITH DISINFECTANT

**“High touch” objects only recently defined (no significant differences in microbial contamination of different surfaces) and
“high risk” objects not epidemiologically defined.**

Touch (manual disinfection not thorough) vs No-Touch (mechanical)

No Touch

(supplements but do not replace surface cleaning/disinfection; avoids the need for “touch” and the problems associated with manual disinfection)

Assessing UVC Disinfection: Microbiological Efficacy and Integration into Hospital Workflow

Elizabeth Bryce, Titus Wong, Tracey
Woznow, Elena Murzello, Mike Petrie,
Amin Kadora

Presentation to the Environmental Hygiene Interest Group
2014 Infection Prevention & Control Conference - Halifax

Conclusion

- Both machines are microbiologically effective
- Functionality and integration into workflow became the primary determinants
- Cycle time becomes paramount in our institution

Carefully consider how your facility operates when selecting UVC machines

Environmental Cleaning in Healthcare:

Is Monitoring of Cleaning Compliance Really Needed?



Michelle J. Alfa, Ph.D., FCCM

Principal Investigator, St. Boniface Research Centre
Winnipeg, MB, Canada

Hosted by Paul Webber
paul@webbertraining.com

Hospital-approved Liquid Disinfectants for Environmental Cleaning

[PIDAC 2012]

- Alcohols: 70-90%
- Chlorines: sodium hypochlorite or bleach
- Hydrogen peroxides: (enhanced action formulations)
- Quaternary ammonium compounds: QUATS [limited bacterial killing ability]
- Phenolics: not to be used in nurseries
- Iodophors: non-antiseptic formulations

Be sure to ensure microbial killing claims are effective in ≤ 3 minutes

Environmental Cleaning Monitoring

PIDAC Recommendations:

- *Process in place to assess quality of cleaning*
- *In addition to visual inspection use of an Audit tool*
- *Regular feedback to housekeeping staff*
- *Action plans when inadequate compliance detected*

Audit Tools:

- UV-visible Marker
- ATP
- Culture



Novel Methods for Environment Disinfection:

- Fogging:
 - VHP,
 - Ozone gas,
 - super-oxidized water,
- UV irradiation:
- Steam:



CleanRoomTechnology website



Lightclean Website



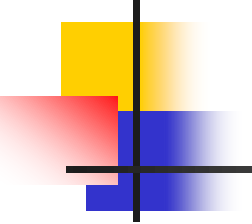
Stambio website

Regardless of Disinfection method used, monitoring cleaning compliance is still needed

Cleaning criteria:	Compliance of Monitoring Method with cleaning criteria			
	<i>UV-Marker</i>	<i>ATP</i>	<i>Culture</i>	<i>Visual Inspection</i>
Surface was wiped	+	+*	+/-	-
Low Organic residuals	-	+	-	-
Low Microbial residuals	-	-***	+	-
No residual AROs	-	-	+	-
Low labour	+	+	-	+
Results available for immediate feedback	+	+	-	+

* Cutoff for adequate cleaning not yet defined (250 RLUs/site suggested)

** ATP lacks sensitivity to detect < 100 cfu/test



ATP levels (RLUs) do NOT correlate with viable count

- Sciortino C et al *Validation and comparison of three ATP luminometers for monitoring hospital surface sanitization: A Rosetta Stone for ATP testing.* AJIC 2012;40:233-9
- Shama G, Malik DJ. *The uses and abuses of rapid bioluminescence-based ATP assays.* Int.J.Hyg.Environ.Health 2013;216:115-25
- Boyce JM et al *Comparison of fluorescent marker systems with 2 quantitative methods of assessing terminal cleaning practices.* ICHE 2011;32:1187-93.

Key Study Conclusions:



HAI rates reduced for VRE, MRSA & *C.difficile*
Three key components:

■ ***Training of Housekeepers:***

- required to demonstrate competency

■ ***Monitoring cleaning compliance:***

- minimal acceptable compliance of 80%
- same-day feedback (re-clean required)

■ ***Effective disinfectant agent:***

- wide range of kill in ≤ 1 min
- container-wipe application system

Environmental Disinfection in 2014: New Technologies, Old Dilemmas

Curtis Donskey, M.D.

Louis Stokes VA Medical Center
Cleveland, Ohio

UV Advantages and Disadvantages

Advantages

- Rapid (15 min; 45 min for C diff)
- Room does not need to be sealed
- Minimal health and safety concerns
- Low operating costs (+/-)

Disadvantages

- No controlled studies showing reduced infections
- Inadequate methods to monitor UV delivery and effectiveness

Improved hydrogen peroxide disinfectants

Advantages

- Fast: 30 sec - 1 min bactericidal and virucidal claim
- Safe (EPA toxicity category, III - Caution)
- Noncorrosive
- Effective on soft surfaces (EPA soft surface claim)
 - Reduced MRSA and VRE on privacy curtains

Disadvantages

- More expensive than Quats
- Not effective against *C. difficile* spores

Summary

The environment plays an important role in transmission of healthcare-associated pathogens

Environmental interventions can reduce transmission, but the quality of the evidence is low

Environmental disinfection can be improved using automated devices or through standard cleaning interventions

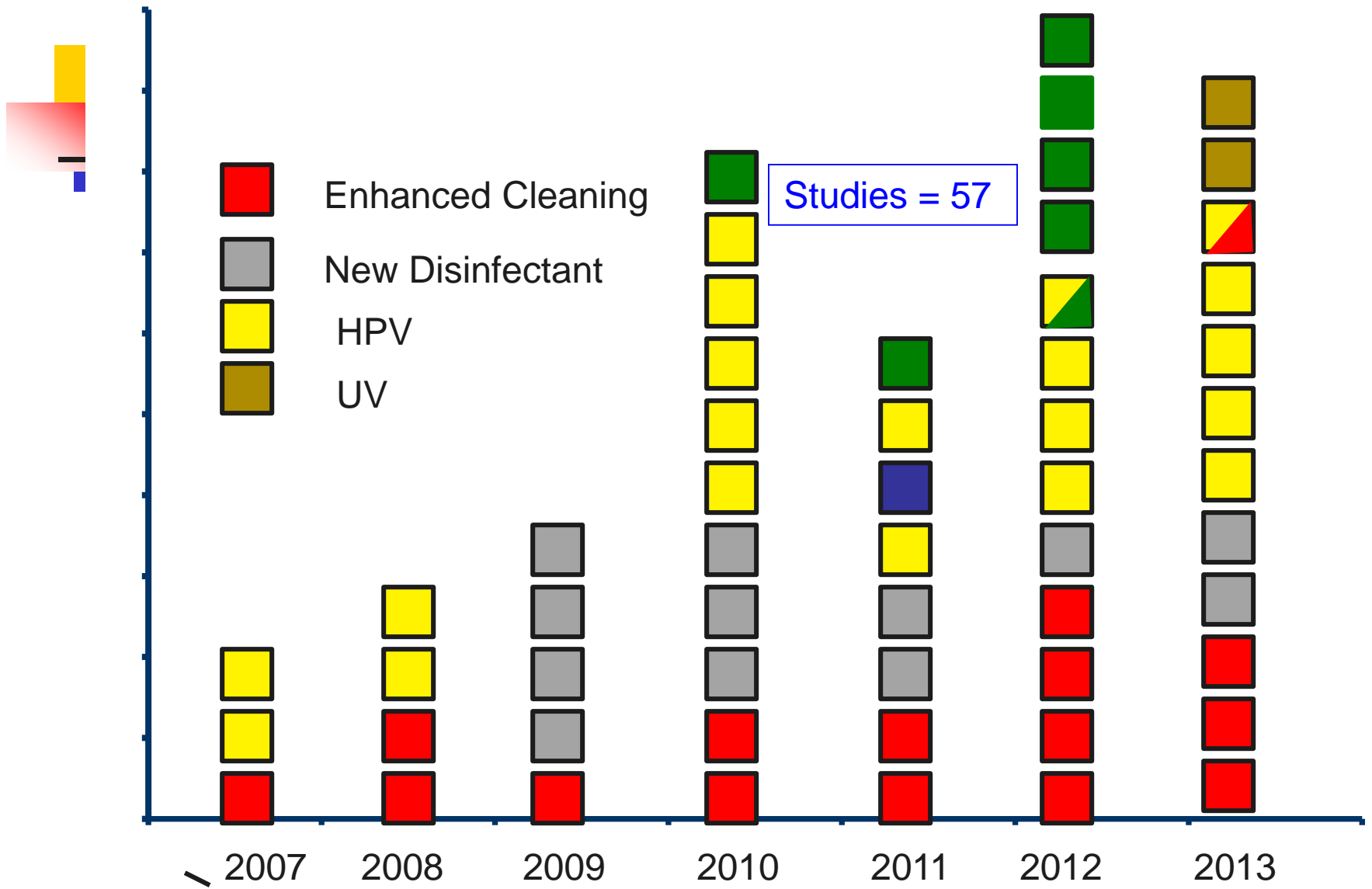
Multiple challenges remain



The Big Picture of Environmental Hygiene Imperatives

Philip Carling, MD

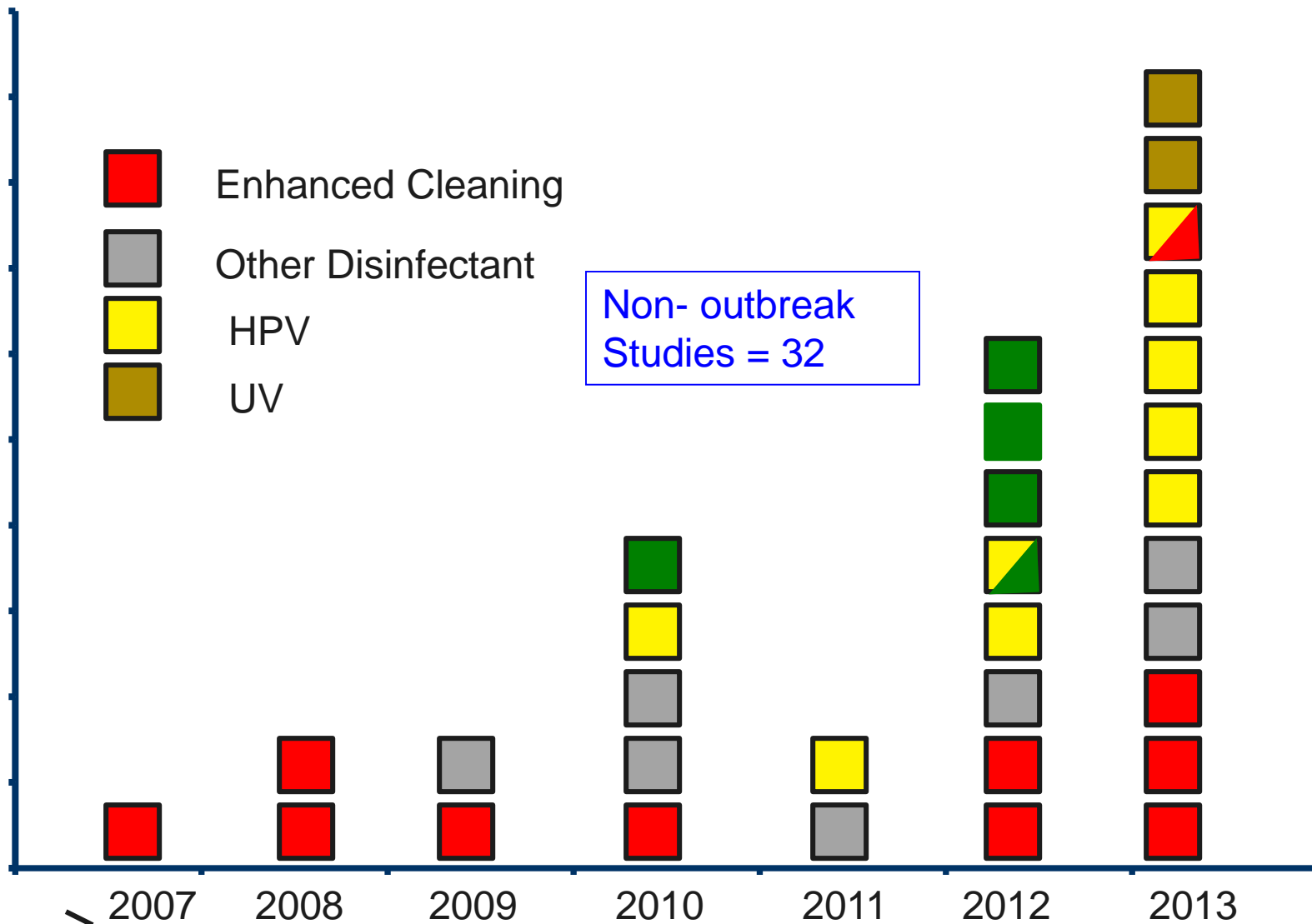
Single intervention clinical studies of environmental hygiene



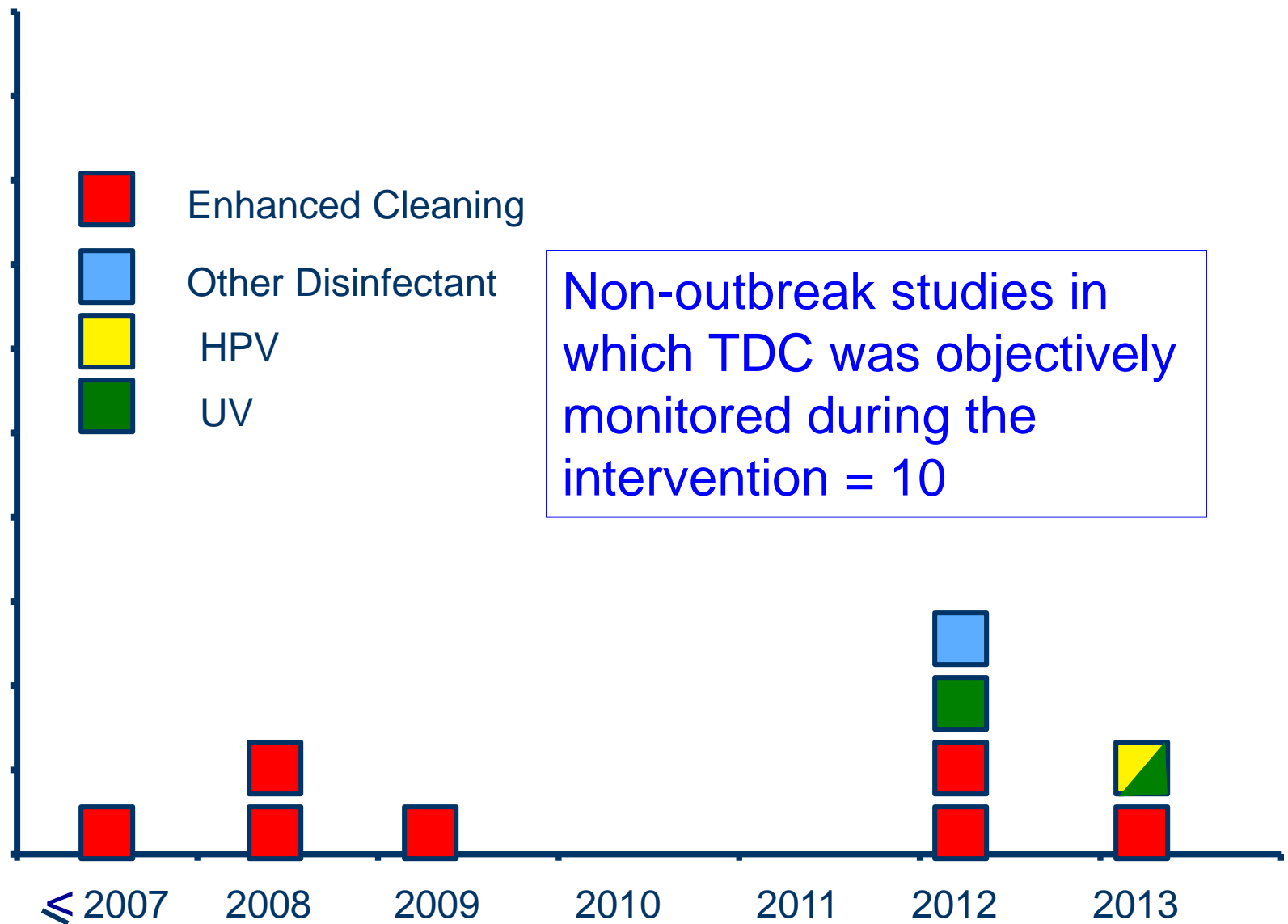
Single intervention clinical studies of environmental hygiene

- Enhanced Cleaning
- Other Disinfectant
- HPV
- UV

Non- outbreak
Studies = 32



Single intervention clinical studies of environmental hygiene



Conclusions

- None of the technologies replace disinfection cleaning
- No-touch technologies have potential value in defined applications
- Studies to assess their possible added benefit in terminal cleaning are in progress

Thank You

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