


**Critique and Use of the Scientific Evidence – Sharpening Skills**  
**Russell Olmstead, St. Joseph Mercy Health System, Michigan**  
**Teleclass broadcast sponsored by Virox Technologies Inc. [www.virox.com](http://www.virox.com)**

**Critique and Use of the Scientific Evidence - Sharpening Skills**

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**Disclosures, R. Olmsted**

- Speakers' Bureau: Advanced Sterilization Products, Ethicon Inc., Sage Products
- Scientific advisor: 3M, Mintie, Inc., Health Research & Education Trust (HRET)- affiliate of American Hospital Association, Premier Inc.

**Agenda**

- List at least one bibliographic search engine to identify evidence related to the practice of infection prevention and control.
- Describe concepts used in critical appraisal of scientific evidence.
- List elements used to score quality and strength of peer reviewed studies.
- List at least one strategy involved in application of evidence to prevent infection.

**Building the Case for Connection Between Scientific Evidence & the Infection Preventionist**

- *APIC/CHICA-Canada infection prevention, control, and epidemiology: Professional and practice standards*; Friedman C, et al. Am J Infect Control 2008

**Practice Standard: Research**

- Participates; evaluates; and/or applies relevant research findings to infection prevention, control, and epidemiology practice
- Critically evaluates published research and incorporates appropriate findings

**Building the Case for Connection Between Scientific Evidence & the Infection Preventionist**

*Outcome competences for practitioners in infection prevention and control*; Burnett E, Competency Steering Workgroup - Infection Prevention Society. J Infect Prev 2011

**Domain: Research**

- Access, appraise and apply robust evidence of all types from a range of research and other sources, to the domains of the role
- Share best practice through the dissemination of evidence and knowledge

**Domain: Education**

- Critical analysis and evaluation of published literature and peer-reviewed research studies

**Building the Business Case for Scientific Evidence & the Infection Preventionist**

- *Competency in infection prevention: A conceptual approach to guide current and future practice*; Murphy DM, et al. Am J Infect Control 2012

**Domain: Infection Prevention & Control**

- The IP must be able to critically evaluate research and apply the findings to their practice setting

**Domain: Performance Improvement & Implementation Science**

- Uses literature review as an essential tool
- Interprets and applies meta-analyses; interprets research findings, identifies study limitations and bias

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APIC Competency Model for the Infection Preventionist

**Research & Implementation Science are elements within the new IP Competency Model published by APIC;**  
 Murphy DM, et al. *Am J Infect Control* 2012 (May);40:296-303

Green areas indicate critical competencies required for the expanding IP role.

APIC  
 American Professional Infection Control Society

The Joint Commission **Expectations for IPs = subject Matter expertise (SME)**

- NPSG.07.03.01:** Implement evidence-based practices to prevent health care–associated infections due to multidrug-resistant organisms in acute care hospitals
- NPSG.07.06.01:** Implement evidence-based practices to prevent indwelling catheter-associated urinary tract infections (CAUTI)

Requirement	Level of evidence
EP 2: Insert indwelling urinary catheters according to established evidence-based guidelines that address the following: <ul style="list-style-type: none"> <li>Limiting use and duration to situations necessary for patient care</li> <li>Using aseptic techniques for site preparation, equipment, and supplies</li> </ul>	A-II
EP 3: Manage indwelling urinary catheters according to established evidence-based guidelines that address the following: <ul style="list-style-type: none"> <li>Maintaining the integrity of the urine collection system</li> <li>Securing catheters for unobstructed urine flow and drainage</li> <li>Replacing the urine collection system when required</li> <li>Collecting urine samples</li> </ul>	A-II A-I B-III A-III
EP 4: Measure and monitor catheter-associated urinary tract infection prevention processes and outcomes in high-volume areas by doing the following: <ul style="list-style-type: none"> <li>Selecting measures using evidence-based guidelines or best practices</li> <li>Monitoring compliance with evidence-based guidelines or best practices</li> <li>Evaluating the effectiveness of prevention efforts</li> </ul>	A-I or B-I for all B-III

Note: Surveillance may be targeted to areas with a high volume of patients using indwelling catheters. High-volume areas are identified through the hospital's risk assessment as required in IC.01.03.01, EP 2.

### Finding the Evidence: Bibliographic Search Engines: tool at your fingertips -

**PubMed®** - U.S. National Library of Medicine's (NLM) bibliographic search system.

It is available *free* on the Internet at <http://pubmed.gov>

- Searchable database system contains:
  - > 21.6 million records from 5,582 publications covering biomedicine and health, 1950 to the present

Uses Medical Subject Headings (MeSH) to create an index of published studies,

example: the term "nosocomial" maps to the MeSH heading "cross Infection." For more details visit: <http://www.nlm.nih.gov/mesh/meshhome.html>

### What's Available from PubMed? Simple Search

- Identify the key concepts for your search.
- Enter the terms (or key concepts) in the search box.
- Suggestions will display as you type your search terms.
- Click [here](#) to run this search in PubMed.

**Example:**

- Type the term, "cross infection Clostridium difficile" into the search window
- Click the search button
- Result = 1,221 retrievable abstracts (when provided) sorted by date of publication (default setting that is modifiable)

Search results for "cross infection clostridium difficile":

- Recent changes in Clostridium difficile infection. Silva Junior M. *Emerg Infect Dis*. 2012 Jan-Mar; 18(1):195-9. Review. PMID: 23045839 [PubMed - indexed for MEDLINE] Free Article [Abstract citation]
- Clinical impact of switching conventional enzyme immunoassay with nucleic acid amplification test for detecting Clostridium difficile-associated colitis. Johnson BV, Kanagan M, Humphries RA, Usain OZ. *Am J Infect Control*. 2012 Oct; 40(10):1019-23. doi: 10.1016/j.ajic.2012.04.329. Epub ahead of print. PMID: 23043489 [PubMed - as supplied by publisher] [Abstract citation]
- Clostridium difficile: Bioterrorism Does Not Predict Severe Infection. Wark ST, Mick D, Jain R, Lo ES, Trivedi J, Liu EW, Almassaha LM, Ewing SA, Ring C, Garock AT, Rogers MA, Washer L, Newton DW, Masari PH, Young VB, Aronoff DM. *Clin Infect Dis*. 2012 Dec; 55(12):1651-6. doi: 10.1093/cid/cir765. Epub 2012 Sep 12. Review. PMID: 22912009 [PubMed - in process] [Abstract citation]

144 free full-text articles in PubMed Central  
 Previews of full-text articles of Clostridium difficile [Clin Infect Dis. 2012]

### What's Available from PubMed? continued

- Advanced search capabilities
- Abstracts: email, clipboard, export to citation management software, etc.
- Full text articles – based on permissions from publisher and/or author
- Additional functions: related citations matcher, Link Out, Clinical Queries
- Tutorial

**FREE full text article** in PubMed Central

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# Critique and Use of the Scientific Evidence – Sharpening Skills

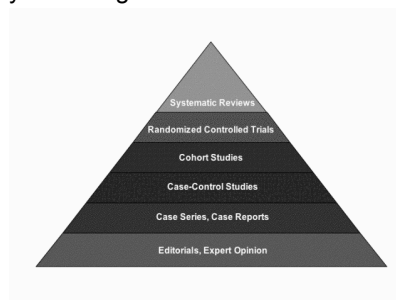
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#### Other Bibliographic Search Engines

- Cumulative Index to Nursing and Allied Health Literature (CINAHL) – hosted by EBSCO
  - [www.ebscohost.com/cinahl](http://www.ebscohost.com/cinahl)
- EBSCO Publishing
  - [www.ebscohost.com](http://www.ebscohost.com)
- OVID
  - Wolters Kluwer Publishing
  - [www.ovid.com](http://www.ovid.com)

#### Hierarchy of Scientific Evidence: rank order of quality of findings

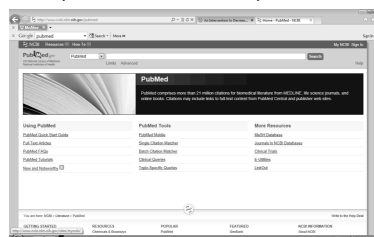


#### Evidence-Based Practice; step-wise approach

- "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research." (Sackett D, 1996)
- Assess and identify the problem
- Develop a question that is in need of an answer
- Locate the scientific evidence that pertains, e.g. search the literature
- Appraise the evidence
- Apply the evidence
- Evaluate the efficacy/ impact of intervention implement based on the evidence

#### Sharpening Your Skills: Locating, Assessing and Grading the Evidence

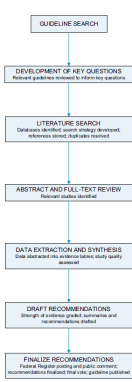
- Step 1. Formulate your question.
- Step 2. Go to PubMed; <http://www.ncbi.nlm.nih.gov/pubmed>



The reason for a bibliographic Index + search engine: 800,000 manuscripts published each year

#### Appraising the Evidence: HICPAC Guidelines Method

- Healthcare Infection Control Practices Advisory Committee (HICPAC), CDC
  - New methodology begun with catheter-assoc. UTI prevention Guideline
  - Umscheid CA, et al. Am J Infect Control 2010;38:264-73
  - Starting point: I've got a question...
  - Targeted systematic reviews of the literature using:
    - "grading of recommendations assessment, development, and evaluation (GRADE) system"



#### GRADE System & Development of Evidence-Based Recommendations, CDC; Umscheid CA 2010

Table 1. Rating the quality of evidence for therapy or harm studies using the GRADE approach

Type of evidence	Initial grade	Criteria to decrease grade	Criteria to increase grade	Overall quality grade
RCT	High	Quality Serious (-1 grade) or very serious (-2 grade)	Strong association	High
Observational study	Low	Serious (-1 grade) or very serious (-2 grade)	Strong evidence of association (+1 grade) or very strong evidence of association (+2 grades)	Moderate
Any other evidence (eg, expert opinion)	Very low	Limitation to study quality	Dose response	Low
		Consistency	Evidence of a dose-response gradient (+1 grade)	Very low
		Directness	Unmeasured Confounders	
		Precision	Inclusion of unmeasured confounders	
		Publication bias	Increase the effect size (+1 grade)	
		High risk of bias (-1 grade)		

GRADE, Grading of Recommendations Assessment, Development, and Evaluation; RCT, randomized controlled trial.

Table 2. Formulating recommendations

HICPAC recommendation	Weighting benefits and harms for critical outcomes	Quality of evidence
Strong (category I)	Interventions with net benefits or net harms	Category IA: high to moderate Category IB: low to very low (established practice)
Weak (category II)	Interventions with trade-offs between benefits and harms	Category IC: high to very low (regulatory)
No recommendation/unresolved issue	Uncertain trade-offs between benefits and harms	High to very low Low to very low

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**Application of GRADE by HICPAC;** MacCannell T, et al. Guideline for the prevention and control of norovirus gastroenteritis outbreaks in healthcare facilities, 2011. [www.cdc.gov/hicpac](http://www.cdc.gov/hicpac)

- **Question 2: What are the best methods to identify an outbreak of norovirus gastroenteritis in a healthcare setting?**
  - Search found: ..moderate quality evidence from a single diagnostic study - use of the Kaplan criteria to detect outbreaks of norovirus gastroenteritis.<sup>16, 116</sup>
  - Recommendation 2.A.1 In the absence of clinical laboratory diagnostics or in the case of delay in obtaining laboratory results, use Kaplan's clinical and epidemiologic criteria to identify a norovirus gastroenteritis outbreak. (**Category IA**)
  - Citations:
    - 16. Kaplan JE, et al. The frequency of a Norwalk-like pattern of illness in outbreaks of acute gastroenteritis. Am J Public Health 1982
    - 116. Turcios RM, et al. Reevaluation of epidemiological criteria for identifying outbreaks of acute gastroenteritis due to norovirus: United States, 1998-2000. Clin Infect Dis. 2006;42(7):964-969

### How Good is the Quality & Quantity of Evidence?

- Preventability of Healthcare associated infections
- Source: Umscheid CA, et al. Infect Control Hosp Epidemiol 2011; 101-114.
  - **Results of literature search and assessment:**
    - 4,847 potentially relevant articles identified
    - 434 articles were retrieved / 64 ultimately met the inclusion criteria
    - Only 15 were part of the final analysis
    - Reasons for elimination of studies from the pool of 64:
      - Low quality score using GRADE system ( 31)
      - > 10 years old (7)
      - Only reported processes – no outcome data (5)
      - Study performed outside the U.S. (11)
  - **Study Conclusions of Preventability? Class assignment - put search terms below in PubMed search window:**
    - umscheid ca cost cross infection 2011

### Resource on Review and Assessment of the Evidence;



What are these results telling me?

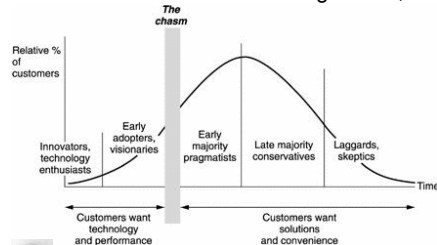
Elizabeth Anne Scicluna  
Infection Control Unit, Mater Dei Hospital, Msida, Malta

- Good review of the following key elements that a smart consumer of evidence needs: case definition, bias/confounding, sample size & power, Meta analysis

### Applications of the Evidence:

Are Infection Preventionists Using the Evidence?

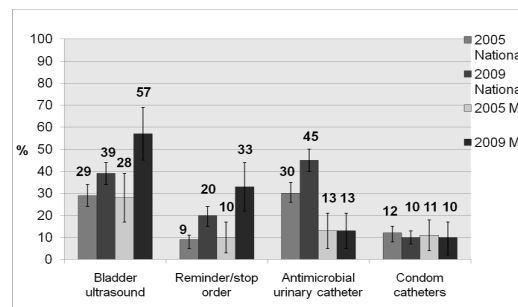
### Model of Diffusion of Innovation: Rogers EM, 1962



1847

How long after Semmelweis' s work did it take for alcohol-based handrub to be used in U.S. hospitals?

### Are Prevention Practices Making it to the Bedside? Case Study using CAUTI. Krein SL, 2010

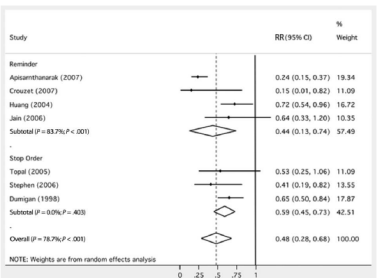


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## Efficacy of Enhancing Catheter Awareness; Why is Use at 20%?

Meddings J, et al. Clin Infect Dis 2010;51:550-60



Rate of CAUTI can be reduced by half with use of catheter reminder or stop order.

## Is there any new evidence on efficacy of antimicrobial urinary catheters?

### • Class assignment # 2:

1. Go to PubMed
2. Type in the following terms in the search window:
3. " antimicrobial urinary catheters 2012 "

- ✓ Take a look at the study you find near the top of the search results



My dog ate my internet browser is not acceptable for completion :-)

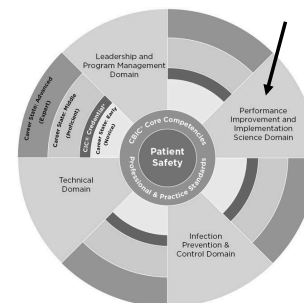
## Implementation Science: A Definition

- 'Implementation Science (IS) is the scientific study of methods to promote the systematic uptake of clinical research findings and other evidence-based practices into routine practice, and hence to improve the quality (effectiveness, reliability, safety, appropriateness, equity, efficiency) of health care. It includes the study of influences on healthcare professional and organisational behaviour.'

– Eccles MP, et al. Implementation Science 2009;4:18

## APIC Competency Model for the Infection Preventionist

Research & Implementation Science are elements within the new IP Competency Model published by APIC; Murphy DM, et al. Am J Infect Control 2012 (May);40:296-303



Green areas indicate critical competencies required for the expanding IP role.

\*The CIC® credential is available from CICAP, The Certification Board of Infection Control and Epidemiology, Inc.



## Implementation Science Across the Career Development of an Infection Preventionist

Novice	Proficient	Advanced
Performs literature searches & reviews	Can critically analyze and assess research findings; identify limitations and bias	Performs and publishes systematic reviews of the literature using GRADE system
Use HAI surv. Findings to identify needs	Apply IS & PI in special projects and daily work; Presents poster session at national IP meeting	Active research program and publishes studies
Begin to understand performance improvement (PI) & IS tools and techniques	Leads or is key member of PI teams – regular member of multi-disciplinary teams on pt. unit	Coordinates multi-facility PI collaboratives

## Moving Evidence from the Journals to the Bedside

- All 4 of the following found correlation between IP with CIC\* and implementation of evidence-based prevention strategies:
  - Pogorzelska M, Stone PW, Larson EL. Certification in infection control matters: Impact of infection control department characteristics and policies on rates of multidrug-resistant infections. Am J Infect Control. 2012 Mar;40(2):96-101.
  - Krein SL, Hofer TP, Kowalski CP, et al. Use of central venous catheter-related bloodstream infection practices by US hospitals. Mayo Clin Proc. 2007;82(6):672-678.
  - Krein SL, Kowalski CP, Damschroder L, et al. Preventing ventilator-associated pneumonia in the United States: A multicenter mixed-methods study. Infect Control Hosp Epidemiol 2008; 29:933-940
  - Saint S, Kowalski CP, Kaufman SR, et al. Preventing hospital-acquired urinary tract infection in the United States: A national study. Clin Infect Dis 2008; 46:243–50.
- \* certification in infection prevention & control

# Critique and Use of the Scientific Evidence – Sharpening Skills

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### Translational Research: Moving Science to Action

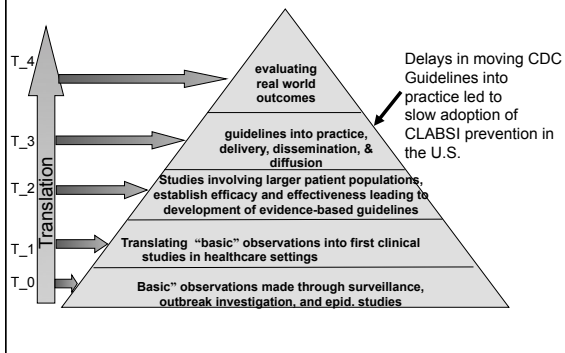
- Definition: Translational research/evaluation involves moving knowledge and discovery gained from the basic *and* **epidemiologic sciences** to its application in clinical and community settings.

### Translational Research: Another model for moving evidence forward

- **T0:** characterized by the discovery of opportunities and approaches to health problems through technologic advances, surveillance, outbreak investigation, and epidemiologic studies.
- **T1:** seeks to move discovery into first application of candidate interventions in healthcare settings and patient populations.
- **T2:** assesses the value of the candidate interventions leading to the development of evidence-based guidelines.
- **T3:** attempts to move evidence-based guidelines into health practice, through delivery, dissemination, and diffusion research. aka *Implementation Science*
- **T4:** seeks to evaluate the “real world” health outcomes of population health practice

Adapted from: Genet Med 2007;9(10):665-674 and <http://www.iths.org/about/translational>

### Future Prevention Successes Depend on Investment in Each Phase of the Research Process ; J. Jernigan - CDC



### Keys for the Elimination of Healthcare-associated Infections

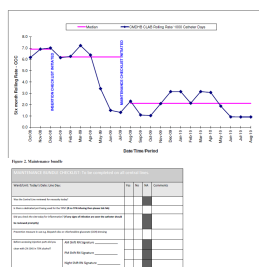
- **Collect data and disseminate results**
- **Full adherence to best practices**
- **Recognize excellence**
- **Identify and respond to emerging threats**
- **Improve science for prevention through research**
- “Sustained elimination of HAIs can be based on this public health model of constant action and vigilance. Elimination will require the implementation of evidence-based practices, the alignment of financial incentives, the closing of knowledge gaps, and the acquisition of information to assess progress and to enable response to emerging threats.

Cardo D, et al. ICHE 2010 Nov;31:1101-5.

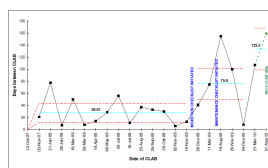


### CLABSI Prevention at Middlemore Hospital, NZ. Seddon ME, et al. NZMJ 2011;124:9-21

Figure 4. CLAB rate per 1000 line days (6 month rolling rate)

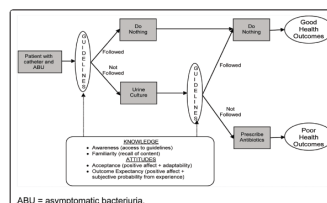


- CLABSI rate decreased from 6.6 to 0.9/1,000 central line days
- Median days between CLABSI events Increased from 30 to > 100



### Antimicrobial Stewardship & The IP

- Trautner BW, et al Implementation Science 2011, 6:41
- A hospital-site controlled intervention using audit and feedback to implement guidelines concerning inappropriate treatment of catheter-associated asymptomatic bacteriuria (ABU)



ABU = asymptomatic bacteriuria.



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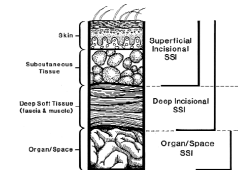
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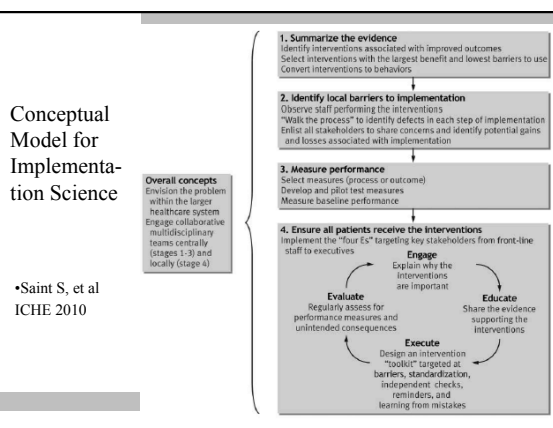
### The efficacy of outcome data in preventing HAIs?

- **Impact of surgeon-specific feedback on surgical site infection (SSI) rates in Thailand.**
  - Kasatpibal N, et al. *J Hosp Infect* 2006;63(2):148-55
- **Observational, before-after trial in 7 Thai hospitals providing surgeon-specific SSI rates & standardized infection ratios (SIR).**
- **Results: Feedback of performance data had no impact on incidence of SSIs**



### Improving Awareness and Use of the Literature

- *Journal Club: A venue to advance evidence-based infection prevention practice.* Manning ML, Davis J. *Am J Infect Control* 2012; pre-press
- Well-recognized strategy used by clinicians to critique and keep up to date with relevant literature
- Example: methods used...
  - Is the study design clearly identified? Is it appropriate?
  - How representative is the sample?



### Thank You...Any questions?

**Additional Resources & Readings:**  
**Centre for Evidence-Based Medicine (Oxford University)**  
<http://www.cebm.net/>  
**Centre for Evidence-Based Medicine (Toronto)**  
<http://ktclearinghouse.ca/cebm/practise/>  
 Dartmouth Biomedical Libraries, U.S -  
[http://www.dartmouth.edu/~biomed/resources.html/guides/ebm\\_resources.shtml#ebm\\_info](http://www.dartmouth.edu/~biomed/resources.html/guides/ebm_resources.shtml#ebm_info)  
 Evidence-Based Nursing Journal:  
<http://ebn.bmj.com/>

**Coming Soon**

- 5 December (FREE ... WHO Teleclass – South Pacific) **New Developments in Infection Control for Renal Dialysis**  
 Speaker: Prof. W.H. Seto, Queen Mary Hospital, Hong Kong  
 Sponsored by World Health Organization, Clean Care is Safer Care
- 06 December **Surface Disinfection and Microbial Resistance**  
 Speaker: Prof Markus Dettlenkoefler, University of Freiburg, Germany  
 Sponsored by Diversey Inc ([www.diversey.com](http://www.diversey.com))
- 11 December (British Teleclass) **Contamination of the Ward Environment – The Importance of Hand Hygiene When Leaving the Patient Zone**  
 Speaker: Dr. Ginny Moore, UCLH Environmental Research Group  
 Sponsored by GOJO ([www.gojo.com](http://www.gojo.com))
- 13 December **Microfibre Cleaning in Healthcare: Is it Really All it's Cracked Up To Be?**  
 Speaker: Dr. Michelle Alfa, St. Boniface Hospital Research Group, Winnipeg

[www.webbertraining.com/schedulepl.php](http://www.webbertraining.com/schedulepl.php)

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