

# Norovirus Outbreaks Issues and Interventions

Dr. Philip Carling, Boston University School of Medicine  
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## Norovirus Outbreaks Issues and Interventions

Philip C. Carling, M.D.  
Boston University School of Medicine

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June 16, 2010

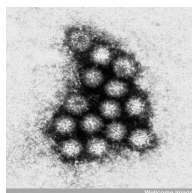
Disclosure

Consultant – Ecolab, Steris, ASHES

## Today's Presentation

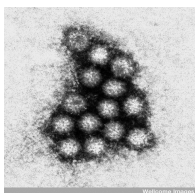
- Norovirus (NoV) Biology
- NoV Epidemiology
- Clinical Features
- Why are NoV outbreaks such a problem in healthcare settings?
- Cruise Ship issues
- "Controlling" Healthcare NoV Outbreaks
- What can we do to prevent NoV outbreaks?

## NoV Biology



- 1968 Gastroenteritis in school children Norwalk, Ohio
- 1971 Cell free filtrates reproduce disease in prisoners
- Hundreds of strains
- Human infection only

## NoV Biology



- 1968 Gastroenteritis in school children Norwalk, Ohio
  - 1971 Cell free filtrates reproduce disease in prisoners
  - Hundreds of strains
  - Human infection only
- What NoV really looks like**

## What NoV really looks like



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Or...maybe more like this...

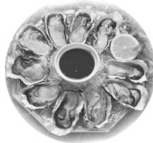


## NoV Epidemiology (General)

- Continuously evolving strains
  - Error prone RNA
  - Recombination between strains
- Influenza - like worldwide
- Fluctuations in disease due to major (2-4 yrs. and minor (continuous) changes in antigenic structure
- Some winter peaks in temperate climates

## NoV Epidemiology – Sporadic Cases

- Rarely a true “foodborne illness”
- Virus does not live in food
- Most cases – Fresh foods served uncooked contaminated by food handlers whose hands are contaminated by NoV due to symptomatic or asymptomatic infection
- Exceptions:
  - Shell fish or drinking water contaminated by sewage



## NoV Epidemiology – Sporadic Cases

Royal Marines help north Wales catering students beat the bugs in the kitchen  
The Royal Navy and Royal Marines Chef Display Team today (Tuesday, January 27th) lent their support to the Welsh Assembly Government's Norovirus awareness campaign by dishing up a feast of food hygiene tips to Bangor college students.

The key reason food gets contaminated



What's wrong in this Picture?

## NoV Epidemiology – Sporadic Cases

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The key reason food gets contaminated



What's wrong in this Picture?

## Susceptibility to NoV Infection

- Immunity and histo-blood group antigens play a role
- Very young, very old and chronically ill people are more susceptible to infection
- Travelers – New strain exposure
- Immunity is short lived

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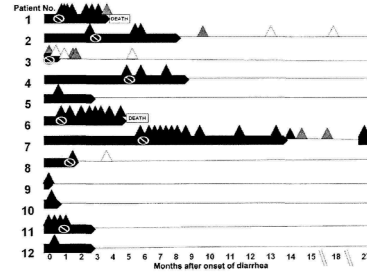
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## NoV Infection

- Infective dose – < 10 viral particles
- Incubation period – 10-51 hours
- Shedding precedes illness in 30% of cases
- Asymptomatic shedding continues for weeks in children and months in some patients

## Nov shedding in renal stem cell recipients

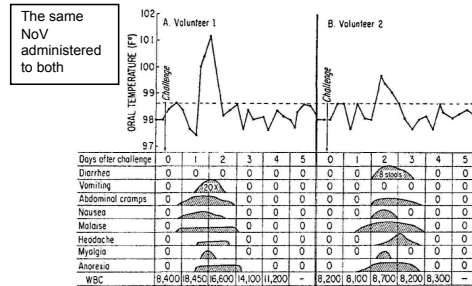


Roddie C, et al. Clin Inf Diseases October 2009

## NoV Clinical Features

- Nausea/vomiting – often first symptom
- Vomiting = **ALARM SYMPTOM** (in outbreak settings)
- Cramps and diarrhea – no blood, no WBC
- Onset often explosive
- Often quite severe
- Fever in 1/2
- Duration
  - Healthy patients – 2-3 d
  - Chronically ill and elderly – 4-6 d

## NoV Clinical Features



Dolan R, Blacklow N, Dupont H. J Infect Dis 1971

## NoV Clinical Features

### Complications:

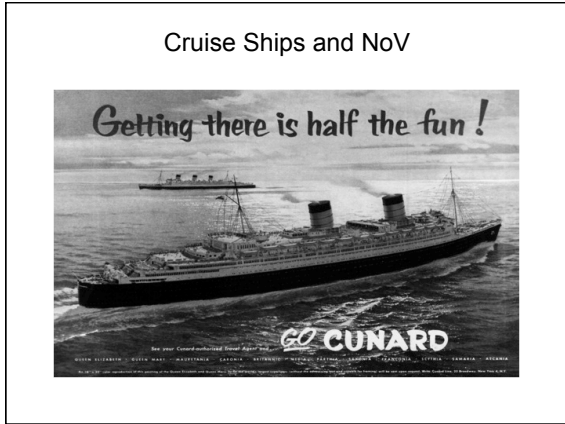
- Necrotizing enterocolitis – infants
- Seizures in children – Japan
- Chronic colitis in immunosuppressed hosts
- Mortality – well recognized but host dependent

## NoV Epidemiology – Outbreaks

- Hospitals
- Extended Care Facilities
- Cruise Ships
- Schools
- Day Care Centers
- Restaurants
- Hotels
- Concert Halls
- Military installations

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Cruise Ships and NoV

- First outbreaks in the 1950s
- CDC Involvement = >2% with GI illness
- 10 – 20 Outbreaks on U.S. vessels / yr.
- > 20% are serially recurrent on the same vessel
- Passengers continue to be blamed

**MAJOR ARTICLE**

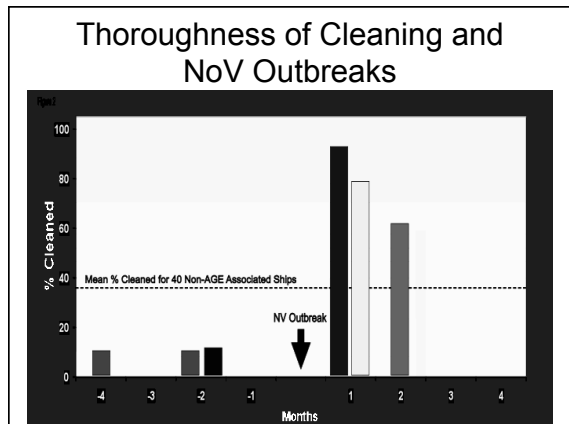
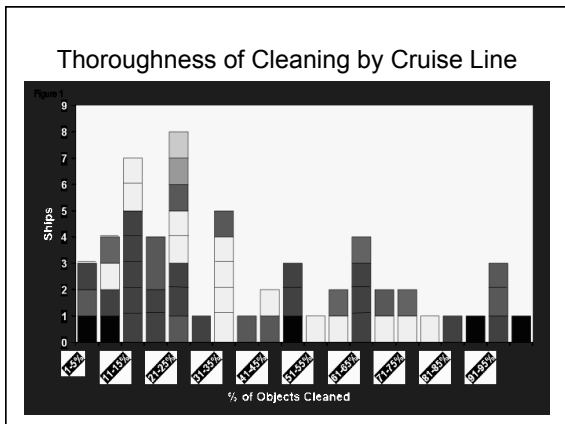
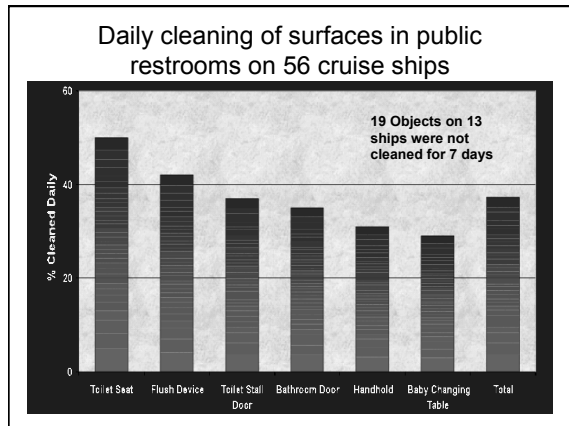
Cruise Ship Environmental Hygiene and the Risk of Norovirus Infection Outbreaks: An Objective Assessment of 56 Vessels over 3 Years

Philip C. Carling,<sup>1</sup> Luz Ann Bravo-Morales,<sup>2</sup> and Jeffrey K. Gillies<sup>3</sup>  
<sup>1</sup>Carmy Hospital, Boston University School of Medicine, <sup>2</sup>Cambridge Health Alliance, <sup>3</sup>Harvard Medical School, and <sup>4</sup>Tufts University Schools of Medicine, Nutrition, and Engineering, Boston, Massachusetts

42 Healthcare workers going on a cruise vacation agreed to evaluate daily thoroughness of public restroom disinfection cleaning

Six objects were covertly marked and evaluated daily for five days in 273 restrooms reflecting 32% of all US cruise ships.

Clinical Infectious Diseases November 2009



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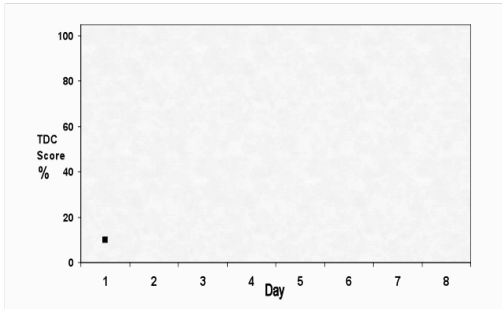
**Industry Response**

CLIA Press release 11/4/09

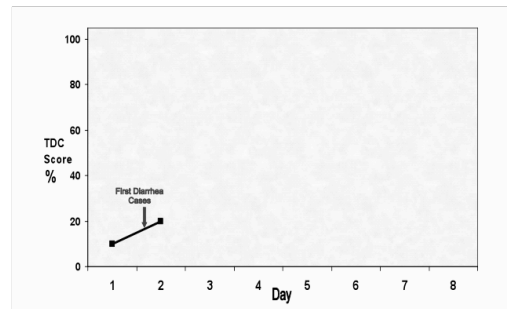
**“We have limited knowledge of the study’s methodology and we are unable to reconcile its conclusions with the industry’s rigorous public health and sanitation procedures and with the excellent vessel sanitation scores our lines receive from the CDC. We have reached out to the authors to learn more about how the study was done....”**

**Serendipity happens  
only  
if you are there for it**

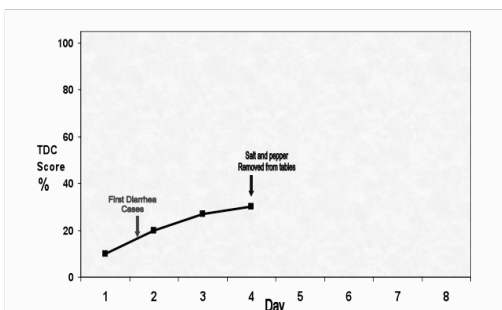
Caribbean Cruise March 2010



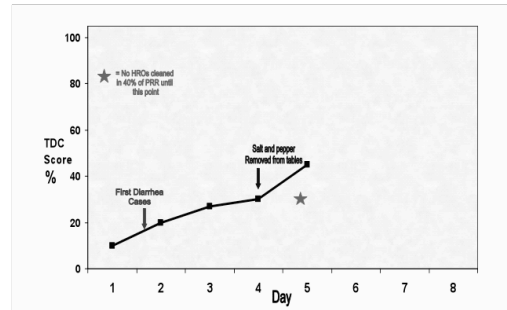
Caribbean Cruise March 2010



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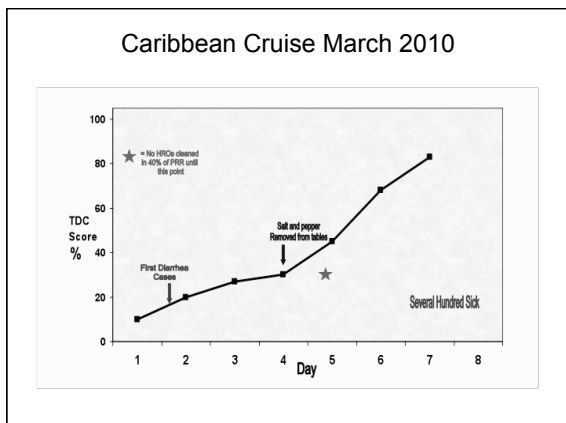
Caribbean Cruise March 2010



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- ### Why are NoV outbreaks such a problem in healthcare settings?
- 10. New strains continuously evolving
  - 9. No long-term immunity
  - 8. No vaccine
  - 7. HCW spread – one to many
  - 6. Shedding precedes illness
  - 5. Extended shedding
  - 4. ABHR have limited impact
  - 3. Disinfection issues
  - 2. Infective dose extremely small
  - 1. Environmental survival

### “Controlling” Healthcare NoV Outbreaks

**PROBLEM**  
No evidence based intervention has yet be shown to be effective

What about bleach?

### What about bleach?

Much more potent in lab than other disinfectants against NoV  
Several studies have shown slight clinical impact (in comparison to discordant controls)  
No studies have evaluated confounders – For example - Prevalence density  
Intensity and thoroughness of cleaning while using bleach has never been evaluated.

For example:  
If thoroughness of cleaning is at 30% and does not change will you see an impact of bleach?  
If thoroughness of cleaning is at 30% and increases to 80% when bleach implemented and NoV in the environment significantly decreased ... was it the bleach? Was it the improved cleaning? Was it both?  
Outbreaks are outbreaks and by definition are finite.

### What about bleach?

Intensity and thoroughness of cleaning while using bleach has never been evaluated.

For example:

- A. If thoroughness of cleaning is at 30% and does not change will you see an impact of bleach?
- B. If thoroughness of cleaning is at 30% and increases to 80% when bleach implemented and NoV in the environment significantly decreased ... was it the bleach? Was it the improved cleaning? Was it both?

Outbreaks are outbreaks and by definition are finite.

### “Controlling” Healthcare NoV Outbreaks

- High index of suspicion
- Reminders to HCW when outbreaks in community (Rapid Testing) – Soon
- Cohorting ill patients
- Personnel control
  - Remain out of work if ill + 72 hours
  - Need strong administrative support
  - Return to work 48 hours? 72 hours? More?


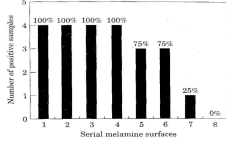
# Norovirus Outbreaks Issues and Interventions

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**“Controlling” Healthcare NoV Outbreaks**

- Soap and water H.H. – Clearly better than ABHR
- Glove use for all patient contact during outbreak?
- Mobile and shared fomite control
- Close to admissions or isolate new admissions?
- Restrict Patient movement ?
- Environmental cleaning
  - Disinfectant – bleach recommended. Other?
- Focus on major fomites  
(forget the clocks)

**Are gloves the answer?**


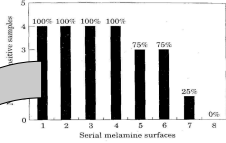



Nice for the HCW.....But

The serial transfer of Human NoV by fecal contaminated (1:5 dilution on toilet tissue) by fingertips

Barker J. J Hosp Infect 2004.

**Are gloves the answer?**


Nice for the HCW.....But

Secondary transfer:  
4/10 doorknobs  
5/10 Telephone receivers  
3/10 Sinks

**“Controlling” Healthcare NoV Outbreaks**

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**What’s wrong with this picture?**



**“Controlling” Healthcare NoV Outbreaks**

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(forget the clocks and walls)

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“Controlling” Healthcare NoV Outbreaks

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“Controlling” Healthcare NoV Outbreaks

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What can we do to prevent NoV outbreaks?

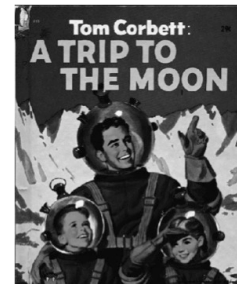
What can we do to prevent NoV outbreaks?

**The Problem**

- NoV infections “happen”
- No vaccine
- No early diagnosis (yet)
- No confirmed means to “control” an outbreak once recognized

**Any Ideas???**

Head for the Moon ?



How about Mars ?



How about Mars ?



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If these are not attractive options...  
we have no choice but to....

Control the Amplifier



Control the Amplifier  
Optimizing Environmental Hygienic Practice



In general most hospitals and  
other healthcare settings are not  
well cleaned

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY NOVEMBER 2008, VOL. 33, NO. 11  
ORIGINAL ARTICLE  
Improving Cleaning of the Environment Surrounding Patients  
in 36 Acute Care Hospitals  
Philip C. Carling, MD; Michael M. Parry, MD; Mark E. Rupp, MD; John L. Po, MD, PhD; Brian Dick, MS, CIC;  
Sandra Von Behren, RN, BSN, MS, CIC; for the Healthcare Environmental Hygiene Study Group

RESULTS

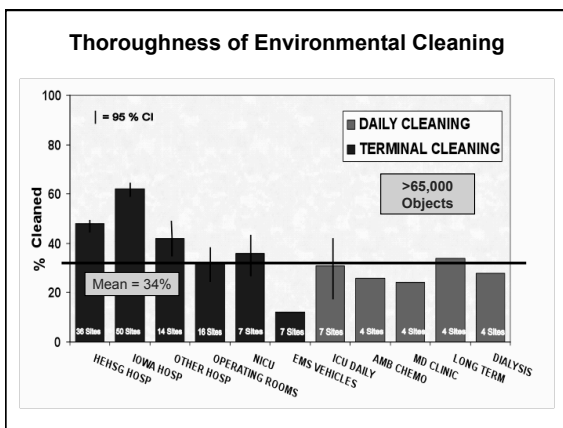
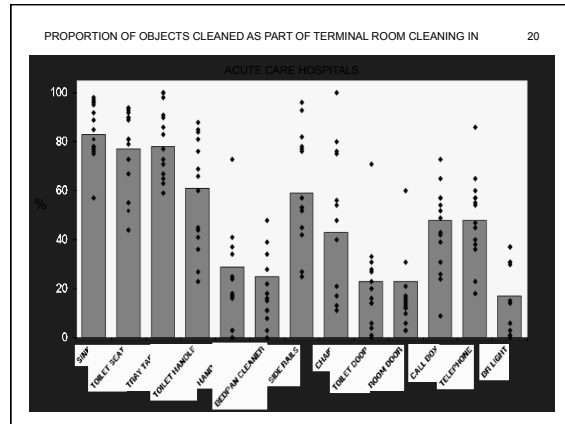
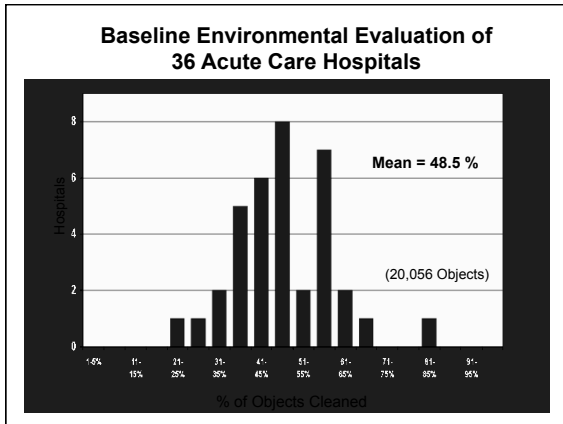
DAZO Solution (AKA – Goo)



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### Cleaning House: A New Metric in the Objective Evaluation of Environmental Cleaning

**Evaluating hygienic cleaning in health care settings: What you do not know can harm your patients**

Philip C. Carling, MD, and Jade M. Bartley, MS, MPH, CIC  
Boston, Massachusetts, and Detroit, Michigan

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

### Approaches to Programmatic Environmental Cleaning Monitoring

Conventional Program	Enhanced Program
• Subjective visual assessment	• Objective quantitative assessment
• Deficiency oriented	• Performance oriented
• Episodic evaluation	• Ongoing cyclic monitoring
• Problem detection feedback	• Objective performance feedback
• Open definition of correctable interventions	• Goal oriented structured Process Improvement model

Carling PC, Bartley JM. AJIC (In-press)

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### Approaches to Programmatic Environmental Cleaning Monitoring

Conventional Program Advantages	Enhanced Program Advantages
An established model	<ul style="list-style-type: none"> <li>Direct evaluation of practice</li> <li>Uses a standardized, consistent, objective and uniform system of monitoring</li> <li>Provides regular and ongoing performance results to ES staff</li> <li>Facilitates the monitoring of many data points to optimize performance analysis</li> <li>Provides positive practice based feedback to ES staff</li> <li>Allows for objective remedial interventions</li> <li>Easily adaptable to existing PI modalities</li> <li>Facilitates compliance with JCAHO standards</li> <li>Facilitates compliance with CMS CoP</li> <li>Intrinsic internal benchmarking</li> <li>External benchmarking, reporting and recognition feasible</li> </ul>

Carling PC, Bartley JM. AJIC (In-press)

### Approaches to Programmatic Environmental Cleaning Monitoring

Conventional Program Limitations	Enhanced Program Limitations
<ul style="list-style-type: none"> <li>Inability to evaluate actual practice</li> <li>Based only on negative outcome analysis</li> <li>Limited generalizability of findings</li> <li>Poor specificity and low sensitivity</li> <li>Intrinsically subjective with a high potential for observer bias</li> <li>Poor programmatic specificity</li> <li>Potential for observer bias</li> <li>Only evaluates daily HP</li> <li>Limited ability to support JCAHO standard EC.04.01.03.EP2</li> <li>Limited ability to demonstrate compliance with CMS CoP 482.42</li> <li>Benchmarking not feasible</li> </ul>	<ul style="list-style-type: none"> <li>Requires a new program implementation</li> <li>Ongoing administrative support critical to success</li> <li>Potential resistance to objective monitoring and reporting</li> <li>While useful, the covert baseline evaluation may be difficult to implement effectively</li> <li>Monitoring tool limitations</li> </ul>

Carling PC, Bartley JM. AJIC (In-press)

### Approaches to Programmatic Environmental Cleaning Monitoring

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Carling PC, Bartley JM. AJIC (In-press)

## Conclusions

- It is very likely that surfaces in the Patient Zone are highly relevant in the transmission of Healthcare Associated Pathogens.
- While optimizing hand hygiene and isolation practice are clearly important, there is no reason why the effectiveness and thoroughness of environmental hygienic cleaning should not also be optimized, particularly since such an intervention can be essentially resource neutral.

## Thanks for Attending !!



Questions – Comments? [pcarling@cchcs.org](mailto:pcarling@cchcs.org)

### THE NEXT FEW TELECLASSES

22 June 10	(British Teleclass) Patient Hand Hygiene – Perceptions & Behaviour Speaker: Emma Burnett, Tayside Hospital, Dundee
24 June 10	Infection as a Risk Factor for Chronic Disease Speaker: Dr. Allison Aiello, University of Michigan
15 Jul. 10	(Free Teleclass) Forever the Unknown: The Lujo Virus Experience in Johannesburg South Africa Speaker: Prof. Adriano Duse, University of the Witwatersrand, South Africa
29 Jul. 10	(Free Teleclass) Addressing Infection Prevention & Control in Low Resource Settings: The IFIC Approach Speaker: Dr. Michael Borg, St. Luke's Hospital, Malta
12 Aug. 10	(Free Teleclass) Positive Deviance: Unleashing Secret Change Agents in Your Hospital to Prevent MRSA Infection Speaker: Dr. Jon Lloyd, Plexus Institute
02 Sep. 10	(Free South Pacific Teleclass ... Live Broadcast from the NDICN Conference, New Zealand) Measuring the Impact of Infection Control

[www.webbertraining.com.schedule1.php](http://www.webbertraining.com.schedule1.php)

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