

# CJTIC

The Canadian Journal of Infection Control  
Revue canadienne de prévention des infections



VOLUME  
**31**  
NUMBER  
**1**

Official Publication of  
**ipac**  
Infection Prevention  
and Control Canada  
**pci**  
Prévention et contrôle  
des infections Canada  
ISSN - 1183 - 5702

Wisdom Begins With Wonder  
IPAC CANADA

Registration Brochure available at  
[www.ipac-canada.org](http://www.ipac-canada.org)

## INSIDE

- 
- 11 Hand hygiene knowledge, attitudes and self-reported behaviour in family medicine residents
- 
- 18 Surgical site infection prevention: What are the gaps in Vietnamese hospitals?
- 
- 24 Spatio-temporal analysis of *Acinetobacter baumannii* outbreak with multiple routes of transmission in ICU setting
- 
- 28 Device-associated infection rates, bacterial resistance, length of stay, and mortality in intensive care units of Costa Rica: Findings of the International Nosocomial Infection Control Consortium (INICC)
- 
- 35 Wound infection due to *Escherichia vulneris*: A rare human pathogen
- 

IPAC CANADA  
NEWS:  
Board Elections

# Disinfection Dysfunction?



## Safety Indifference Syndrome

Some disinfectants may pose a health risk to users, patients and the environment. Using a disinfectant with a preferred safety profile will increase user compliance.



## Dwell Time Disease

Many disinfectants evaporate before achieving disinfection. Using disinfectants that stay wet for the required contact time will increase product compliance.



## Label Deficit Disorder

Some disinfectants have labels that are ambiguous. Due diligence is required to effectively select disinfectants to meet regulatory compliance.



## Cross Contamination Conundrum


Some disinfectants can transfer pathogens from surface to surface during the disinfection process. Disinfectants that inhibit cross contamination prevent outbreaks and aid in protocol compliance.

Talk  
CLEAN  
to Me

blog

**VIROX**  
TECHNOLOGIES INC.

Visit us at [virox.com](http://virox.com)



*The truth is,  
**C. difficile, MRSA  
and VRE may have been  
admitted to all these rooms.***

- 33% of non-CDI rooms have tested positive for *C. difficile*.<sup>1</sup>
- 55% of high-touch areas in patient rooms have tested positive for *C. difficile*.<sup>1</sup>
  - Admitting a new patient to a room previously occupied by a MRSA or VRE-positive patient, significantly increases the odds of acquiring MRSA or VRE.<sup>2</sup>

**When the problems are facility-wide,  
the solutions have to be.**



**Clorox Healthcare™ Professional  
Disinfecting Bleach Products  
kill *C. difficile* spores quickly:  
wipes 3 minutes, liquids 5 minutes,  
and 46 other pathogens  
like MRSA & VRE in 1 minute\***





# ABOVE & BEYOND

The Complete Solution in the hospital-wide fight against HAIs.

## Optimum-UV™ System:

- 4-log reduction of *C. difficile* in 5 minutes at 8 feet.
- >5-log reduction of 30 pathogens in 5 minutes at 8 feet, including the following:
  - Methicillin-resistant *Staphylococcus aureus* (MRSA)
  - *Escherichia coli* (E. coli)
  - *Pseudomonas aeruginosa*
  - *Acinetobacter baumannii*
  - Vancomycin-resistant enterococci (VRE)
  - Norovirus
  - *Klebsiella pneumoniae*
  - Influenza A
  - Polio Type 1



**OPTIMUM UV™**  
SYSTEM

Powered by **UVDI** technology

## Comprehensive Prevention — so you're fully covered.

We all know the battle against HAIs must be fought on many fronts and on just about every surface. That's why we offer a full line of products — from a range of powerful manual disinfectants to a leading-edge UV system. Clorox Healthcare® — taking care of all your disinfecting needs.



### Professional Disinfecting Bleach Wipes & Cleaner:

- Kill *C. difficile* spores in as fast as 3 minutes\* and another 46 pathogens in 1 minute.

### Hydrogen Peroxide Cleaner Disinfectant Wipes:

- Kill 38 bacteria and viruses in 30-60 seconds.

\*3 minutes (wipes), 5 minutes (pull top squeeze bottle)



HEALTHCARE®



NEEDLESTICK PREVENTION THAT MEETS YOUR NEEDS



automated needle retraction  
prevents exposure to the  
contaminated sharp



ACTIVATED VANISHPOINT SYRINGES  
REQUIRE LESS DISPOSAL SPACE THAN  
OTHER SAFETY SYRINGES & PREVENT  
DISPOSAL-RELATED INJURIES



easy  
**ONE-HANDED**  
activation!

OTHER AVAILABLE SAFETY PRODUCTS



VanishPoint®  
Blood Collection Set



VanishPoint®  
Blood Collection  
Tube Holder



VanishPoint®  
IV Catheter



Patient Safe®  
Syringe



**RETRACTABLE  
TECHNOLOGIES, INC.**

[www.vanishpoint.com](http://www.vanishpoint.com)

P: 972.294.1770 • F: 972.294.4400

Toll Free: 1.888.703.1010

[rtiservice@vanishpoint.com](mailto:rtiservice@vanishpoint.com)

511 Lobo Lane • Little Elm, Texas 75068-0009 • USA

VOLUME  
31  
NUMBER  
1

# CJIC

The Canadian Journal of Infection Control  
Revue canadienne de prévention des infections

## FEATURES

- 11 Hand hygiene knowledge, attitudes and self-reported behaviour in family medicine residents
- 18 Surgical site infection prevention: What are the gaps in Vietnamese hospitals?
- 24 Spatio-temporal analysis of *Acinetobacter baumannii* outbreak with multiple routes of transmission in ICU setting
- 28 Device-associated infection rates, bacterial resistance, length of stay, and mortality in intensive care units of Costa Rica: Findings of the International Nosocomial Infection Control Consortium (INICC)
- 35 Wound infection due to *Escherichia vulneris*: A rare human pathogen

## IPAC CANADA NEWS

- 45 President's Message
- 46 Message de la présidente
- 47 From the Executive Desk
- 49 2016 National Education Conference
- 59 Board Elections
- 65 Honorary Member
- 66 CIC® Graduates

The Canadian Journal of Infection Control is the official publication of Infection Prevention and Control Canada (IPAC Canada). The Journal is published four times a year by Craig Kelman & Associates, Ltd. and is printed in Canada on recycled paper. Circulation 3000.

Advertising or products and services in the Canadian Journal of Infection Control does not imply endorsement by IPAC Canada. ©2016 Craig Kelman & Associates Ltd. All rights reserved. The contents of this publication, which does not necessarily reflect the opinion of the publisher or the association, may not be reproduced by any means, in whole or in part, without the written consent of the publisher.

ISSN - 1183 - 5702

Indexed/abstracted by the Cumulative Index to Nursing and Allied Health Literature, SilverPlatter Information Inc. and EBSCO.

The Canadian Journal of Infection Control is a 'Canadian periodical' as defined by section 19 of the Canadian Income Tax Act. The deduction of advertising costs for advertising in this periodical is therefore not restricted.



[www.ipac-canada.org](http://www.ipac-canada.org)



**EDITOR-IN-CHIEF**

Chingiz Amirov, MPH, MSc QIPS, CIC

**EDITORIAL BOARD**

- Sandra Callery, RN, MHSc, CIC, Toronto, Ontario
- Heather Candon, BSc, MSc, CIC, Toronto, Ontario
- Laurie Conway, PhD, CIC, Toronto, Ontario
- Brenda Dyck, BScN, CIC, Winnipeg, Manitoba
- Bruce Gamage, RN BSN, BSc, CIC, Vancouver, British Columbia
- Zahir Hirji, RN, BScN, MHSc, CIC, Toronto, Ontario
- Elizabeth Henderson, PhD, Calgary, Alberta
- Mary LeBlanc, RN, BN, CIC, Tyne Valley, Prince Edward Island
- Yves Longtin, MD, FRCPC, CIC, Montreal, Quebec
- Allison McGeer, MD, FRCPC, Toronto, Ontario
- Matthew Muller, MD, PhD, FRCPC, Toronto, Ontario
- Cathy Munford, RN, CIC, Victoria, British Columbia
- Victoria Williams, B.Sc, B.A.Sc, MPH, CIC, Toronto, Ontario
- Dick Zoutman, MD, FRCPC, Kingston, Ontario

**EDITORIAL OFFICE**

Chingiz Amirov, MPH, MSc QIPS, CIC  
 Director, Infection Prevention and Control  
 Baycrest Health Sciences  
 3560 Bathurst Street  
 Toronto, Ontario M6A 2E1  
 Tel: 416-785-2500 Ext. 2981 Fax: 416-785-2503  
 Email: editor-in-chief@ipac-canada.org

**WEB COMMUNICATION MANAGER**

Shirley McDonald, ART, CIC webmaster@ipac-canada.org

**POSTING EMPLOYMENT**

**OPPORTUNITIES/OTHER INFORMATION**  
 IPAC Canada Membership Services Office  
 info@ipac-canada.org

**PUBLISHER**



3rd Floor, 2020 Portage Avenue  
 Winnipeg, MB R3J 0K4  
 Tel: (204) 985-9780 Fax: (204) 985-9795  
 www.kelman.ca E-mail: info@kelman.ca

EDITOR - Cheryl Parisien  
 DESIGN/PRODUCTION - Jackie Magat  
 MARKETING MANAGER - Al Whalen  
 ADVERTISING COORDINATOR - Stefanie Hagidiakow

Send change of address to:

IPAC Canada  
 P.O. Box 46125, RPO Westdale,  
 Winnipeg, MB R3R 3S3  
 info@ipac-canada.org



Publications Mail Agreement #40065075  
 Return undeliverable Canadian addresses to: lauren@kelman.ca

**SUBSCRIPTIONS**

Subscriptions are available from the publisher at the following rates: All Canadian prices include GST. Prices are listed as personal/institutional.  
 Canada: \$30/\$38 (GST # 100761253); USA (in US funds): \$28/\$36; Other countries: \$45/\$60.

Subscriptions do not include online access to the journal. Members have online access to the current issue.

**VISION**

IPAC Canada – a national and international infection prevention and control leader.

**MISSION**

IPAC Canada is a multidisciplinary member based association committed to public wellness and safety by advocating for best practices in infection prevention and control in all settings.

IPAC CANADA is now on  
 FACEBOOK, TWITTER and LINKED IN



## Disinfection That Is Fast. Effective. Responsible. Sustainable.



1 Minute Contact Time



3-5 Minute Contact Time



5 Minute Contact Time



- Accel® bactericidal/virucidal solutions help eliminate HAs within every cleaning and disinfection workflow.
- Accel® cleaner disinfectants tap into the power of AHP® - Accelerated Hydrogen Peroxide, so they're effective, yet gentle on people, assets and the environment. With AHP technology, quat binding is never a worry.
- Accel® PREvention™ AHP® liquid formulation is the only intermediate cleaner/disinfectant with UL/EcoLogo certification for third party, unbiased globally recognized environmental sustainability.

### Choose Your Disinfection Dwell Time:

Accel® INTERvention™ (RTU and wipes) - one minute against TB.

Accel® PREvention™ (UL/EcoLogo certified liquid AHP formulation) - three minutes against TB and fungi for RTU and wipes; five minutes for concentrate.

Accel® TB (RTU and wipes) - five minutes against TB and fungi.



## HELPING YOU ACHIEVE TOTAL DISINFECTION



Products



Procedures



Validation

To learn more about the difference Accel® disinfectant cleaners with AHP® can make in your facility, call customer service at 1-800-668-7171.



# THIS JUST IN!

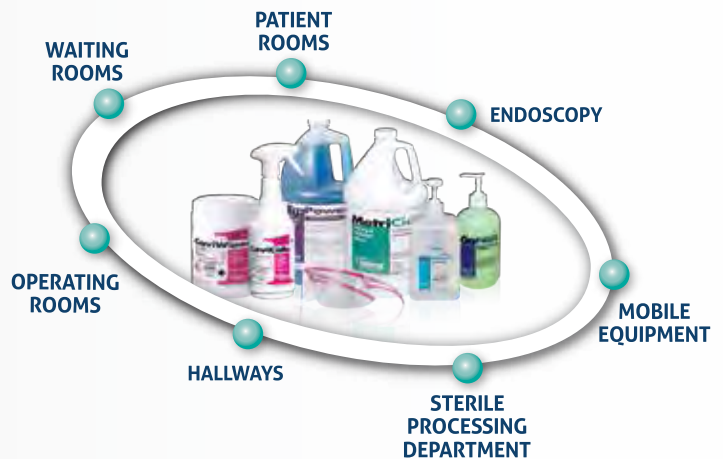
CaviWipes1™ now kills Norovirus in 1 minute.



Only Metrex™ protects you and your patients across the entire Infection Prevention Circle of Care™.

Trust the company thousands of healthcare facilities use every day...Trust Metrex for all your surface disinfection needs.

At Metrex, we strive to continuously improve our products. CaviWipes1 now kills Norovirus in just 1 minute and with only 1 step.



To learn more about CaviWipes1, scan the QR code or visit [CaviWipes1.com/IPAC](http://CaviWipes1.com/IPAC)

**Metrex has been Protecting People across healthcare for over 25 years.**

©2015 Metrex Research. All Rights Reserved.  
Metrex, CaviWipes1, CaviCide1, EmPower, VioNex, VioNexus, Googles and MetriCide are trademarks of Metrex Research, LLC.

**Metrex™**  
Protecting People

AN-2015-03-0026

**hygie**<sup>®</sup>

# Fighting Together Hospital Aquired Infections



Hygie<sup>®</sup> Bedpan Support with Hygienic Cover

Super-absorbent pad Absorbs and gelifies

### HYGIENIC COVERS<sup>®</sup>

Designed for the safe collection, transportation and disposal of bodily fluids. The unique super-absorbent pad included in each bag turns liquid waste into gel within seconds. Used with the Commode Chair and Hygie<sup>®</sup> Supports (Bedpan, Urinal and Vomit)

### Hy21<sup>®</sup> Bedpan Support

Used with the Hygienic Covers<sup>®</sup>, the Hy21<sup>®</sup> Bedpan Support replaces the standard and orthopedic bedpans by offering a 2-in-1 design which combines the benefits of both bedpan types. The revolutionary Hy21<sup>®</sup> Technology facilitates handling and use for all patients requiring a bedpan.

### WASH GLOVES

Hygie<sup>®</sup> disposable Wash Gloves are pre-moistened, no water required, with a hypoallergenic cleansing lotion.

- ✓ Prevent cross contamination
- ✓ Complete bathing for bedridden patients
- ✓ Practical and effective
- ✓ Single-use

**More than  
65 products**



Hygie<sup>®</sup> Urinal Support

**NEW**



Hygie<sup>®</sup> Vomit Support



Hygie<sup>®</sup> Alu-Classic Commode Chair



**Used in more than 700 Health Facilities**

1.866.588.2221 | [www.hygie.com](http://www.hygie.com)

**PLATINUM:**

**• 3M Healthcare**  
Ph: (519) 452-6069  
Fax: (519) 452-6597

**• Ecolab Healthcare**  
Ph: (651) 293-2914  
(800) 352-5326  
Fax: (651) 204-7372

**• GOJO Industries**  
Ph: (800) 321-9647 ext. 6829  
Fax: (330) 869-1796

**• SealedAir Diversey**  
Ph: (262) 631-4132 Fax: (262) 631-4036

**• Virox Technologies**  
Ph: (800) 387-7578 (905) 813-0110  
Fax: (905) 813-0220

**• The Clorox Company of Canada**  
Ph: (866) 789-4973

**SILVER:**

**• DebMed**  
Ph: (519) 443-8697 Fax: (519) 443-5160

**• Hygie Canada**  
Ph: (450) 444-6777 Fax: (450) 444-6222

**• Sage Products**  
Ph: (815) 455-4700

**• Stericycle**  
Ph: (647) 288-3296

**• Vernacare**  
Ph: (416) 661-5552 ext. 232  
Cell: (416) 580-9301

**• Webber Training**  
Ph: (613) 962-0437 Fax: (613) 969-7465

**BRONZE:**

**• Ansell**  
Ph: (450) 266-1850 Fax: (450) 266-6150

**• ArjoHuntleigh Canada**  
Ph: (800) 665-4831 Fax: (800) 309-7116

**• Chem-Aqua**  
Tel: 905-457-2434  
Email: [subrotoc@nch.com](mailto:subrotoc@nch.com)  
Website: [www.chemaqua.com](http://www.chemaqua.com)

**• Class 1 Inc.**  
Ph: (519) 650-2355

**• Handy Metrics Corporation**  
Ph: (416) 800-1743

**• healthCentric**  
Ph: (905) 696-6800 Fax: (905) 696-0899

**• Imperial Surgical**  
Ph: (514) 631-7988 ext. 41  
Fax: (514) 631-7741

**• Medela Canada**  
Ph: (905) 608-7272 ext. 229  
(800) 435-8316  
Fax: (905) 608-8720

**• Nosotech Inc.**  
Ph: 418-723-0862  
Fax: 418-723-2231

**• SciCan**  
Ph: (416) 446-2757 Fax: (416) 445-2727

**• Steris Corporation**  
Ph: (905) 677-0863 Fax: (905) 677-0947

**• The Stevens Company**  
Ph: (905) 791-8600 Fax: (905) 791-6143

**• Wood Wyant**  
Ph: (800) 361-7691 Fax: (450) 680-9735

# IPAC CANADA

## 2015 - 2017 Board of Directors

### Executive Officers

**President**

**Suzanne Rhodenizer Rose, RN, BScN, MHS, CIC**  
Health Services Manager  
– Infection Prevention & Control  
Central & Western Zones  
Nova Scotia Health Authority  
VG Site, 846 Bethune Building  
1279 South Park Street  
Halifax, NS B3H 2Y9  
Phone: 902-473-4048  
Fax: 902-473-3295  
[president@ipac-canada.org](mailto:president@ipac-canada.org)

**President-elect**

**Molly Blake, BN, MHS, GNC(C), CIC**  
Infection Control Professional  
Winnipeg Regional Health Authority  
232A North Pavilion, 2109 Portage Ave.  
Winnipeg, MB R3J 0L3  
Phone: 204-833-1742 Fax: 204-940-2182  
[mblake@wrha.mb.ca](mailto:mblake@wrha.mb.ca)

**Treasurer**

**Michael Rotstein, RN, MHS, CIC, CHE**  
Manager, Infection Control  
and Medical Device Reprocessing  
St. Joseph's Health Centre  
30 The Queensway  
Toronto, ON M6R 1B5  
Phone: 416-530-6486 ext. 4581  
[mrotstein@stjoestoronto.ca](mailto:mrotstein@stjoestoronto.ca)

**Secretary**

**Marilyn Weinmaster, RN, BScN, CIC**  
Infection Control Practitioner  
Regina Qu'Appelle Health Region  
430 Pioneer Drive  
Regina, SK S4T 6L8  
Phone: 306-751-5261 Fax: 306-359-1402  
[marilyn.weinmaster@rqhealth.ca](mailto:marilyn.weinmaster@rqhealth.ca)

### Directors

**Barbara Catt, RN BScN Med CIC**  
Infection Prevention & Control Coordinator  
Sunnybrook Health Sciences Centre  
2075 Bayview Ave, B112  
Toronto, ON M4N 3M5  
Tel: 416-480-6100 Fax: 416-480-6845  
[barbara.catt@sunnybrook.ca](mailto:barbara.catt@sunnybrook.ca)

**Mandy Deeves, RN, MPH, CIC**  
Network Coordinator  
Public Health Ontario – Simcoe Muskoka Infection  
Control Network  
80 Victoria Street, Suite 7  
Orillia, ON L3V 7E4  
Tel: 705-418-0253 Fax: 705-326-5434  
[Mandy.deeves@oahpp.ca](mailto:Mandy.deeves@oahpp.ca)

**Camille Lemieux, BScPhm, MD, LLB, CIC**  
Associate Hospital Epidemiologist  
University Health Network  
200 Elizabeth St.  
Toronto, ON M5G 2C4  
Tel: 416-340-4800 Fax: 416-340-5047  
[Camille.lemieux@uhn.ca](mailto:Camille.lemieux@uhn.ca)

**Victor Leung, MD, FRCPC**  
Infection Prevention and Control Physician  
Providence Health Care  
1190 Hornby Street, 4th Floor  
Vancouver, BC V6Z 2K5  
Tel: 604-806-0357 Fax: 604-806-8165  
[vleung@providencehealth.bc.ca](mailto:vleung@providencehealth.bc.ca)

**Ramona Rodrigues, RN BSc MSc(A) CIC CNS**  
McGill University Health Centre,  
Montréal General Hospital  
1650 Cedar ave.  
Montréal, QC H3G 1A4  
Phone: 514-934-1934 Ext: 42047  
Fax: 514-934-8427  
[ramona.rodrigues@muhc.mcgill.ca](mailto:ramona.rodrigues@muhc.mcgill.ca)

**Public Representative**  
(to be elected May 2016)

### Other Positions

**Editor-in-Chief –  
Canadian Journal of Infection Control**

**Chingiz Amirov, MPH, MSc QIPS, CIC**  
Director, Infection Prevention and Control  
Baycrest Health Sciences  
3560 Bathurst Street  
Toronto, ON M6A 2E1  
[editor-in-chief@ipac-canada.org](mailto:editor-in-chief@ipac-canada.org)

**Web Communications Manager**

**Shirley McDonald, ART, CIC**  
RR 3, 4759 Taylor-Kidd Blvd  
Bath, ON K0H 1G0  
Tel: 613-389-9810 Fax: 613-389-8468  
[webmaster@ipac-canada.org](mailto:webmaster@ipac-canada.org)

**Online Novice IP&C Course  
Coordinators**

**Heather Candon, BSc, MSc, CIC**  
**Jane Van Toen, MLT, BSc, CIC**  
[baside@ipac-canada.org](mailto:baside@ipac-canada.org)

**Social Media Manager**

**Barley Chironda, RPN, CIC**  
[info@ipac-canada.org](mailto:info@ipac-canada.org)

### Professional Agents

**Legal Counsel**

**Terrance Carter/Theresa Man**  
Carters Professional Corporation  
211 Broadway  
Orangeville, ON L9W 1K4  
Tel: 519-942-0001  
[tcarter@carters.ca](mailto:tcarter@carters.ca)

**Auditor**

**Philip Romaniuk, CA**  
Stefanson Lee Romaniuk  
1151 Portage Avenue  
Winnipeg, MB R3G 0S9  
Tel: 204-775-8975  
[promaniuk@slrca.ca](mailto:promaniuk@slrca.ca)

### Membership Services Office

**Executive Director**

**Gerry Hansen, BA**  
PO Box 46125 RPO Westdale,  
Winnipeg, MB R3R 3S3  
Tel: 204-897-5990/866-999-7111  
Fax: 204-895-9595  
[executivedirector@ipac-canada.org](mailto:executivedirector@ipac-canada.org)

Deliveries only:  
67 Bergman Crescent, Winnipeg, MB R3R 1Y9

**Administrative Assistant**

**Kelli Wagner**  
Tel: 204-488-5027 Fax: 204-488-5028  
Toll-Free: 1-855-488-5027  
[admin@ipac-canada.org](mailto:admin@ipac-canada.org)

**Conference Coordinator**

**Pat Rodenburg**  
Tel: 780-436-0983, ext. 234  
Fax: 780-437-5984  
[pat@buksa.com](mailto:pat@buksa.com)

**General Information:**

[info@ipac-canada.org](mailto:info@ipac-canada.org)

# Contain Infection

With Vernacare's Human Waste Disposal Systems



## The Recommended Approach



**The Public Health Agency of Canada** recommends the utilization of disposable bedpans and the installation of macerator systems to help avoid cross-contamination in healthcare facilities.\*

Source: \*Public Health Agency of Canada - Infection Prevention and Control Guidance for Management in Acute Care Settings.

**Vernacare**<sup>™</sup>  
cleaner safer healthcare

For more information:  
1-800-268-2422 • [www.vernacare.com](http://www.vernacare.com)

# Hand hygiene knowledge, attitudes and self-reported behaviour in family medicine residents

Vic Sahai, MSc<sup>1</sup>, Karen Eden, MA<sup>2</sup>, Shari Glustein, MLIS<sup>3</sup>,

<sup>1</sup>Director of Hotel Dieu Hospital Research Institute & Business Development  
Assistant Professor, Department of Public Health Sciences, Queen's University

<sup>2</sup>Research Assistant at Hotel Dieu Hospital Research Institute, Kingston, Ontario

<sup>3</sup>Research Assistant at Hotel Dieu Hospital Research Institute, Kingston, Ontario

Biostatistician/Epidemiologist and Assistant Professor Department of Ophthalmology Queen's University and Hotel Dieu Hospital Kingston, Ontario

Corresponding Author: **Robert Nesdole**, MEd, PhD

Biostatistician/Epidemiologist and Assistant Professor Department of Ophthalmology Queen's University and Hotel Dieu Hospital Kingston, Ontario

Hotel Dieu Hospital

166 Brock St.

Kingston, Ontario, Canada K7L 5G2

T: 613-544-3400 ext. 3292

robert.nesdole@queensu.ca

*No funding was received for this project. All authors declare no conflict of interest.*

## ABSTRACT

**Background:** Each year, millions of patients worldwide contract hospital-acquired infections (HAIs), and some die as a result. Hand hygiene (HH) is important in controlling HAIs, yet HH adherence is especially poor among physicians. Only few studies have examined self-reported behaviour of medical residents as they transition from learning to practice. The objective of this study was to better understand knowledge and self-reported HH behaviour of first and second year Family Medicine residents affiliated with Queen's University in Kingston, Ontario, Canada.

**Methods:** A cross-sectional survey design consisting of primarily closed ended questions and one open ended question was used to assess the self-reported HH knowledge and behavior of medical residents.

**Results:** On average, the knowledge score of possible clinical HH moments was 42.2%. The most frequently identified moment of HH was before patient contact (78.5%). The least frequently identified moment of HH was before (8.9%) and after (6.3%) the use of Personal Protective Equipment (PPE). No significant differences in HH knowledge were found for year of residency, gender or undergraduate education in Health Sciences. Residents who attended Canadian medical schools had a significantly higher knowledge of HH than did residents not trained in Canada.

**Conclusion:** To improve HH knowledge and behaviour among Family Medicine residents, a more rigorous, standardized infection control curriculum is needed.

## INTRODUCTION

Hand hygiene (HH) plays a key role in reducing infection transmission rates in hospitals. Hospital-acquired infections (HAIs) are the most frequent adverse event in healthcare worldwide resulting in significant financial loss and patient mortality (1). In developed countries, 5-15% of hospitalized patients (9-37% in Intensive Care Units) contract an HAI (1). The chance of acquiring an HAI in Canadian hospitals is approximately one in ten for adults and one in 12 for children (2). Although HH is vital to reducing HAIs, campaigns to sustainably increase compliance have been unsuccessful (3). Self-reported and observed HH adherence among health care professionals (including students) is approximately 40-70% or lower, (4-16) while in Canada adherence can be as low as 25% (17).

Reasons for lack of HH adherence include: attitudes and low knowledge regarding infection control practices; poor access to sanitizer, sinks, soap and gloves; personal concerns such as

skin irritation; lack of time due to clinical responsibilities and poor mentoring (4) (5) (6) (18) (19) (15) (16) (20) (8) (21) (10) (11) (14). HH adherence is also influenced by healthcare workers' level of training; with higher levels of medical training associated with lower HH compliance (5) (10). Health knowledge refers to the information and understanding about a health-related issue. Knowledge is a necessary component of behaviour change, but is not sufficient on its own to bring about change in behaviour. An attitude is the psychological evaluation of health-related knowledge in terms of like or dislike (22), while behaviour is the result of the interrelationship between knowledge and attitudes. As such, the interrelationship between knowledge and attitudes inform behaviour. Self-reported behaviour is captured using methods of data collection that depend on participants to report their behaviours, thoughts, or feelings (23, 24). Studies examining HH-related knowledge, attitudes and behaviour (5) (9) (15) (16), suggest medical students are more compliant

## Acknowledgements

We wish to acknowledge the support of Hotel Dieu Hospital Infection Control specialists Kelly Monaghan and Ian Kudryk and thank Queen's University Faculty of Health Sciences, as well as the Department of Family Medicine for their assistance with this study. We are also grateful to Dr. G. DiDiodato for permission to modify and use his questionnaire. **The authors declare no conflict of interest. No financial support was needed for this study.**

**TABLE 1:** Residents' self-reported hand hygiene behaviour:

	Always (n=89)	Almost Always (n=89)	Sometimes (n=89)	Rarely (n=89)
Before patient contact	40 (48.2%)	42 (50.6%)	1 (1.2%)	0
Before aseptic procedures	68 (81.9%)	15 (18.1%)	0	0
After bodily fluid exposure	78 (94%)	5 (6%)	0	0
After patient contact	43 (51.8%)	38 (45.8%)	2 (2.4%)	0
After touching patient environment/surroundings	26 (31.3%)	48 (57.8%)	8 (9.6%)	1 (1.2%)
Before blood sample collections	55(69.9%)	18 (22.8%)	2 (2.5%)	0
After blood sample collections	58 (73.4%)	14 (17.7%)	3 (3.8%)	0
Before wearing gloves	23 (28%)	36 (43.9%)	19 (23.2%)	4 (4.9%)
After removal of gloves	49 (59%)	30 (36.1%)	4 (4.8%)	0

with HH than physicians. Basurrah et al. (5) identified a 70% compliance rate for medical students and 9% for physicians. Kadi et al. (15) also found 29% of medical students could identify all 5 WHO moments of HH. Differences in HH compliance between physicians and medical students are well documented; however, few studies have examined self-reported behaviour of medical residents as they transition from learning to practice. This study investigated knowledge and self-reported behaviour related to HH within a clinical setting among first and second year Family Medicine residents at Queen's University.

## METHODS

### Study design

A cross-sectional study design was used to examine self-reported behaviour related to HH practices among first and second year Family Medicine residents.

### Study protocol

A questionnaire consisting of closed questions and one open-ended question was used to capture self-reported HH knowledge and behaviour. Prior to administering the questionnaire face validity was confirmed by three infection control specialists and Research Ethics approval was received.

### Data collection

Cross-sectional survey data was collected from medical residents in a lecture hall. Residents were informed their participation was voluntary and they could withdraw at any time. Participants were given both written and verbal instructions to complete the questionnaire (Appendix 1).

### Outcome measures

The outcome measures of interest were HH knowledge and self-reported behaviour.

### Data analysis

Data were analyzed using IBM SPSS (2012) Statistics for Windows, Version 21.0 (Armonk, NY: IBM Corp.). Chi Square and t-tests as well as two-way ANOVA tests were used to test significance levels. Statistical significance was set at  $p=.05$ .

## RESULTS

Of the 150 medical residents enrolled in the two-year Family Medicine Program 89 (59%) participated in this study; 52% were in first year and 48% were second year residents. Sixty-four percent of the medical residents who participated in this study were female and 36% were male. Ages ranged from 25 years to 47 years ( $M=29$  years). Sixty-four percent were 29 years of age or younger. Eighty-eight percent had an undergraduate degree in Health Sciences; 81% attended medical school in Canada, while 19% attended medical school elsewhere (i.e., Australia, Caribbean, Egypt, Iran, Sudan, United States, United Kingdom and Hungary).

Family Medicine residents were found to have a mean HH knowledge, based on the WHO Guidelines on Hand Hygiene in Health Care (1), of 42.2%. The following moments of HH were frequently identified by medical residents: before patient contact (79%), after patient contact (65%), before entering/ touching patient environment and after leaving/touching patient environment (62%), before aseptic procedure (43%), after fluid exposure/aseptic procedure (38%), and when hands are visibly soiled (14%). The least frequent moments of HH identified by

## APPENDIX A: Moments of Hand Hygiene Questionnaire

PAGE 1 of 3

1. Please list below, to the best of your knowledge, the “moments of hand hygiene” in health care.

2. Please indicate the year in which you were born: Year: 19\_\_\_\_\_

3. What is your sex? Male  Female

4. What is your year of training?

1st year medical student

2nd year medical student

3rd year medical student

4th year medical student

1st year resident

2nd year resident

5. In what field was your undergraduate degree?

6. At which university did you attend medical school?

7. What is your country of origin?

8. Other than through your current course, have you ever had:

YES NO

(a) training in universal precautions in hygiene

(b) training in microbiology

(c) training in hand hygiene

9. Are you completing or have you completed the “JUST CLEAN YOUR HANDS” education and training module?

YES  NO  DON'T KNOW

9(a) If YES, approximately, how long ago did you complete the module? \_\_\_\_\_ months ago

10. Have you worked either as a volunteer or paid employee in a health care setting, prior to medical school? YES  NO

11. How many weeks on average have you spent in the clinical setting? \_\_\_\_\_ weeks

12. Have you ever treated a patient with a hospital acquired infection? YES  NO

If YES:

12(a) The hospital-acquired infection was at least partly attributable to the care provided to the patient while in hospital.

Strongly Disagree  Disagree  Undecided  Agree  Strongly Agree

12(b) Better hand hygiene practices could have prevented this hospital-acquired infection.

Strongly Disagree  Disagree  Undecided  Agree  Strongly Agree

medical residents were in relation to PPE; before use (8.9%) and after use (6.3%). No significant differences were found in mean HH knowledge by year of residency, gender or having an undergraduate degree in health sciences. Residents who attended Canadian medical schools were found to have greater HH knowledge ( $M=4.40$ ) than residents who did not ( $M=2.93$ ),  $p=0.01$ . Younger residents (<29 years) had greater HH knowledge ( $M=4.11$ ) than their older counterparts ( $M=3.32$ ),  $p=.03$ . A two-way ANOVA test, to determine co-variance between students not trained in Canada and age, revealed poor HH knowledge was associated with prior medical training outside of Canada ( $F=4.4$ ,  $df=1$ ,  $p=0.041$ ), while age was not associated with HH knowledge ( $F=0.915$ ,  $df=1$ ,  $p=0.342$ ).

Examination of self-reported HH adherence behaviour rates indicated both first and second year medical residents reported adherence as “always” or “almost always” for each HH scenario (see Appendix A); no difference was found between years of residency (Table 1). Residents reported to “always” perform HH for the following scenarios: after bodily fluid exposure (94%), before aseptic procedure (82%), after blood sample collection (73%), before blood sample collection (70%), after removal of gloves (59%), after patient contact (52%), before patient contact (48%), and after touching patient environment/surroundings (31%). Conversely, residents reported they were least likely to perform HH before wearing gloves (“always” 28%; “rarely” 5%).

In assessing attitudes, Family Medicine residents were asked to use a five-point Likert scale to indicate their level of agreement with the statement “hand hygiene compliance among healthcare providers is a serious problem”; 50% “agreed” with the statement, 31% were “undecided”, and 20% “disagreed” or “strongly disagreed”. A non-significant trend was noted for year of residency. When asked if better hand hygiene practices could have prevented HAIs among patients they have treated, 55% of medical residents “disagreed” and 45% “agreed” or “strongly agreed” better HH would aid in preventing HAIs.

## DISCUSSION

Since the SARS epidemic in 2003 and with current awareness of HAIs, one would hope that HH knowledge would be higher; however, Family Medicine residents surveyed demonstrated little knowledge of recommended HH practices. Although the most commonly identified HH moment was before patient contact, less than half self-reported “always” performing HH for this scenario; suggesting knowledge of HH moments does not necessarily translate into adherence. This finding is similar to Herbert et al., (9) who reported 70% of medical students indicated an *excellent/good* knowledge of HH guidelines, but only 43% adhered to WHO HH recommendations.

Our findings indicated self-report behaviour of HH before and after using PPE was low; a third of the sample reported “always” performing HH before the use of gloves. Few residents

correctly identified the need for HH after the use of gloves; however, there was higher self-reported HH adherence. This raises questions whether lack of recall of an HH moment translates into poor HH behaviour in clinical settings. More concerning is, despite medical residents self-reporting “always” or “almost always” performing HH for each clinical scenario, self-reported behaviour for clinical scenarios were never higher than 82%.

Lack of knowledge and low self-reported HH behaviour, especially in relation to using PPE, raises serious concerns in light of the recent Ebola outbreak, where nurses in the US reported lack of clear guidelines, training and knowledge in the use of PPE (25). Appropriate understanding of HH guidelines when using PPE is also relevant given incorrect removal of PPE was the reported reason a Spanish nurse contracted Ebola (26). This study indicates HH education must be reinforced during medical residency programs. Review and reformulation of HH training in medical school and residency is therefore recommended. To this end, using best practice examples from hospitals meeting HH targets is important. The application of paradigms from behavioural psychology to better translate knowledge into behaviour is also encouraged. Additionally, gaps in HH knowledge between medical residents trained inside and outside of Canada need to be addressed.

Several limitations of this study should be acknowledged. This research used self-reported HH behaviour, which can be higher than actual adherence. Generalization of the results is also limited as only one residency program was studied. Future research would benefit from investigating actual observed HH adherence in comparison to self-reported HH behaviour and its effect on other aspects of infection control. Longitudinal studies of HH knowledge, attitudes and behaviour in medical students as they progress through medical school, residency and professional practice would allow trends to be identified, and gaps to be addressed. Multi-site studies would provide meaningful aggregate data and comparison opportunities. There is also a need to investigate how knowledge of HH can be better translated into practice.

## CONCLUSION

HH adherence is essential in preventing HAIs. This study raises questions regarding the reinforcement of HH knowledge and adherence in infection control practices among medical residents. Low levels of knowledge among Family Medicine residents regarding HH behaviour, particularly for those not trained in Canada, suggests the need for a more rigorous, standardized, accountable infection control curriculum. Emphasis placed on the rationale for HH, the importance of adherence to recommended guidelines, and periodic assessment of knowledge and practice is needed. By addressing this issue at its roots it is hoped that the rate of HAIs can be attenuated.



## APPENDIX A: Moments of Hand Hygiene Questionnaire (continued)

PAGE 2 of 3

13. Having witnessed a missed opportunity for hand hygiene, I would feel comfortable having a conversation about the importance of hand hygiene compliance with that person if the person was;

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(a) Nurse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Physician	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Family member of patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Administrator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Dietitian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Volunteer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Paramedic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) Allied healthcare professional	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Having witnessed a missed opportunity for hand hygiene, I have approached that person and discussed with them the importance of hand hygiene when that person was:

	Never	Rarely	Occasionally	Almost Always	Always	N/A
(a) Nurse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Physician	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Family member of patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Administrator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Dietitian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Volunteer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Paramedic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) Allied healthcare professional	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. If you did not perform hand hygiene in front of the patient, how comfortable would you be if they asked you to clean your hands before you touched them?

Not comfortable at all	<input type="checkbox"/>
Not very comfortable	<input type="checkbox"/>
Somewhat comfortable	<input type="checkbox"/>
Comfortable	<input type="checkbox"/>
Very comfortable	<input type="checkbox"/>

16. If you had performed hand hygiene but not in front of the patient, would you perform hand hygiene again if they asked you?

Yes	<input type="checkbox"/>
No, with an explanation	<input type="checkbox"/>
No, without an explanation	<input type="checkbox"/>

17. Rate your knowledge of:

	Excellent	Good	Satisfactory	Sufficient	Not-Sufficient
(a) General hygiene guidelines for healthcare settings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) The World Health Organization's "My five moments of Hand Hygiene"	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## APPENDIX A: Moments of Hand Hygiene Questionnaire (continued)

PAGE 3 of 3

18. Please indicate which hand hygiene technique(s) you would use in each of these situations:

	Soap and water	Alcohol-based hand rub	Both Soap and water and Alcohol-based hand rub
(a) BEFORE taking a patient's pulse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) BEFORE dressing a wound	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) When hands are visibly soiled	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) AFTER taking a patient's pulse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) AFTER touching a patient's bed rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) AFTER removing gloves used when treating a patient suspected of having <i>C. difficile</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

19. How often do you perform hand hygiene?

	Always	Almost always	Sometimes	Rarely	Never
(a) BEFORE patient contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) BEFORE aseptic procedures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) AFTER bodily fluid exposure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) AFTER patient contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) AFTER touching patient surroundings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) BEFORE blood sample collections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) AFTER blood sample collections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) BEFORE wearing gloves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(i) AFTER removal of gloves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

20. Do you shake hands with the patient when greeting each other?

- Always
- Often
- Sometimes
- Seldom
- Never

21. Rate your agreement:

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Agree
(a) 100% compliance with hand hygiene for every moment in every patient is an achievable goal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Repeated failure to comply with hand hygiene despite education, training, and system engineering to facilitate compliance along with repeated warnings should eventually result in escalated penalties regardless of professional status.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Lack of hand hygiene compliance among healthcare providers is as serious a problem for a patient as a medical error.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Healthcare provider immunization with seasonal flu vaccine is an important patient safety initiative.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## REFERENCES

- World Health Organization. WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge: Clean Care is Safer Care. Geneva, Switzerland; 2009.
- Office of the Auditor General of Ontario. Prevention and Control of Hospital-acquired Infections. Special Report [Internet]. Toronto; 2008. Available from: [http://www.auditor.on.ca/en/reports\\_en/ha\\_i\\_en.pdf](http://www.auditor.on.ca/en/reports_en/ha_i_en.pdf)
- Samuel R, Shuen A, Dendle C, Kotsanas D, Scott C, Stuart RL. Hierarchy and hand hygiene: would medical students speak up to prevent hospital-acquired infection? *Infect Control Hosp Epidemiol*. 2012 Aug;33(8):861–3.
- Anwar MA, Rabbi S, Masroor M, Majeed F, Andrades M, Baqi S. Self-reported practices of hand hygiene among the trainees of a teaching hospital in a resource limited country. *J Pak Med Assoc*. 2009 Sep;59(9):631–4.
- Basurrah MM, Madani TA. Handwashing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh, Saudi Arabia. *Scand J Infect Dis*. Informa UK Ltd UK; 2009 Jul 8;38:620–4.
- O'Boyle CA, Henly SJ, Larson E. Understanding adherence to hand hygiene recommendations: the theory of planned behavior. *Am J Infect Control*. 2001 Dec;29(6):352–60.
- Bukhari SZ, Hussain WM, Banjar A, Almaimani WH, Karima TM, Fatani MI. Hand hygiene compliance rate among healthcare professionals. *Saudi Medical Journal*. 2011. p. 515–9.
- Pittet D, Simon A, Hugonnet S, Pessoa-Silva CL, Sauvan V, Perneger T V. Hand hygiene among physicians: performance, beliefs, and perceptions. *Ann Intern Med* [Internet]. 2004 Jul 6 [cited 2014 Dec 2];141(1):1–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/15238364>
- Herbert VG, Schlumm P, Kessler HH, Frings A. Knowledge of and Adherence to Hygiene Guidelines among Medical Students in Austria. *Interdiscip Perspect Infect Dis*. 2013 Jan;2013:802930.
- Scheithauer S, Haefner H, Schwanz T, Lopez-Gonzalez L, Bank C, Schulze-Röbbecke R, et al. Hand hygiene in medical students: performance, education and knowledge. *Int J Hyg Environ Health*. 2012 Sep;215(5):536–9.
- Sharma S, Sharma S, Puri S, Whig J. Hand hygiene compliance in the intensive care units of a tertiary care hospital. *Indian J Community Med*. 2011 Jul;36(3):217–21.
- Snow M, White GL, Alder SC, Stanford JB. Mentor's hand hygiene practices influence student's hand hygiene rates. *Am J Infect Control*. Elsevier; 2006 Feb 2;34(1):18–24.
- Takahashi I, Osaki Y, Okamoto M, Tahara A, Kishimoto T. The current status of hand washing and glove use among care staff in Japan: its association with the education, knowledge, and attitudes of staff, and infection control by facilities. *Environ Health Prev Med*. 2009 Nov 1;14(6):336–44.
- Duroy E, Coutour X Le. L'hygiène hospitalière et les étudiants en médecine. *Med Mal Infect* [Internet]. Elsevier Science; 2010 [cited 2014 Dec 2];40(9):530–6. Available from: <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.elsevier-222d8f82-ba3c-3d73-a5d8-e2199fd24f7b>
- Kadi A Al, Salati S. Hand hygiene practices among medical students. *Interdiscip Perspect Infect Dis*. 2012;2012:6.
- Kalata NL, Kamange L, Muula AS. Adherence to hand hygiene protocol by clinicians and medical students at Queen Elizabeth Central Hospital, Blantyre-Malawi. *Malawi Med J*. 2013 Jun;25(2):50–2.
- Didiodato G. Has Improved Hand Hygiene Compliance Reduced the Risk of Hospital-Acquired Infections among Hospitalized Patients in Ontario? Analysis of Publicly Reported Patient Safety Data from 2008 to 2011. *Infect Control Hosp Epidemiol*. 2013;34(6):605:610.
- Graf K, Chaberny IF, Vonberg R-P. Beliefs about hand hygiene: a survey in medical students in their first clinical year. *Am J Infect Control*. Elsevier; 2011 Dec 12;39(10):885–8.
- Hunt DCE, Mohammudally A, Stone SP, Dacre J. Hand-hygiene behaviour, attitudes and beliefs in first year clinical medical students. *J Hosp Infect*. Elsevier; 2005 Apr 4;59(4):371–3.
- Mani A, Saini R, Shubangi A. Hand hygiene among healthcare workers. *Indian J Dent Res*. 2010;Jan-Mar:115.
- Roberto MS, K M, SA. S. Social and moral norm differences among Portuguese 1st and 6th year medical students towards their intention to comply with hand hygiene. *Psychol Heal Med*. 2012;17(4).
- Eagly, Alice H., and Shelly Chaiken. "Attitude structure and function." 1998.
- American Psychological Association: Self-Report Measures. (n.d.). In *Alleydog.com's online glossary*. Retrieved from: [http://www.alleydog.com/glossary/definition-cit.php?term=Self-Report Measures](http://www.alleydog.com/glossary/definition-cit.php?term=Self-Report%20Measures)
- Didiodato G. Just clean your hands: measuring the effect of a patient safety initiative on driving transformational change in a health care system. *Am J Infect Control* [Internet]. Elsevier; 2013 Nov 11 [cited 2014 Oct 27];41(11):1109–11. Available from: <http://www.ajicjournal.org/article/S0196655313002241/fulltext>
- National Nurses United. National Nurses Statement on New CDC Ebola Guidelines | National Nurses United [Internet]. National Nurses United Press Release. 2014 [cited 2014 Dec 2]. Available from: <http://www.nationalnursesunited.org/press/entry/national-nurses-statement-on-new-cdc-ebola-guidelines/>
- Phillip A, Sun L, Dennis B. Second Ebola case confirmed. Texas health worker wore "full" protective gear. [Internet]. *The Washington Post*. 2014 [cited 2014 Dec 2]. Available from: <http://www.washingtonpost.com/news/post-nation/wp/2014/10/12/dallas-health-care-worker-who-treated-thomas-eric-duncan-has-tested-positive-for-ebola/> 🌸

# Surgical site infection prevention: What are the gaps in Vietnamese hospitals?

Nguyen Viet Hung, MD, PhD<sup>1</sup>, Truong Anh Thu, MD, PhD<sup>1</sup>, Tetsuya Yagi, MD, PhD<sup>2</sup>, Nobuyuki Hamajima, MD, PhD<sup>3</sup>, Nguyen Quoc Anh, MD, PhD<sup>4</sup>

<sup>1</sup>Department of Infection Control, Bach Mai Hospital, Hanoi, Vietnam

<sup>2</sup>Nagoya University Graduate School of Medicine, Department of Infectious Diseases, Nagoya, Japan

<sup>3</sup>Department of Healthcare Administration, Nagoya University Graduate School of Medicine, Nagoya, Japan

<sup>4</sup>Department of Anesthesiology, Bach Mai Hospital, Hanoi, Vietnam

Address correspondence to **Truong Anh Thu, MD, PhD**

Department of Infection Control, Bach Mai Hospital, 78 Giai Phong, Dong Da, Hanoi, Vietnam

truonganhthu2704@yahoo.com

Mobile: +84904198118

## ABSTRACT

**Background:** Surgical site infections (SSIs) could be prevented by using evidence-based recommended practices. However, surveillance programs for these practices remain inadequate and inaccurate in developing countries. This study evaluated the compliance of surgical team members (STMs) and patients with recommended practices for SSI control and prevention in Vietnamese hospitals.

**Methods:** An observational survey was conducted between November 2009 and February 2010 to evaluate the compliance with SSI control and prevention practices including preoperative showering, hair removal, surgical hand preparation and surgical attire use in the elective surgical patients and STMs at four hospitals. All types of elective surgery were included. Each practice was evaluated based on five items following standard guidelines.

**Results:** During the survey period, 568 elective surgical patients, 864 STMs and 5,509 STM turns (entries/exits to and from the operation room) were observed. The median scores for preoperative showering, hair removal, surgical hand preparation, and surgical attire were 2.0 (0-4.0), 5.0 (0-5.0), 2.0 (0-4.0), and 4.0 (0-5.0), respectively. Cross-hospital comparisons demonstrated significant differences for patient showering and hair removal practices among the participating healthcare institutions. The compliance of STMs with surgical hand preparation and surgical attire use was significantly influenced by hospital and professional activity.

**Conclusions:** Our findings indicate poor compliance with some routine SSI control and prevention practices in Vietnamese hospitals, and also emphasize the need for adapting the guidelines to the local setting, local needs, and resource limitations of health care facilities combined with intensive education, auditing and surveillance strategies to address this issue.

## KEY WORDS

Compliance; prevention; surgical site infection; surgical team member; Vietnam

## INTRODUCTION

Surgical site infections (SSIs) are challenging problems with reported rates ranging from 5% to 30% (1,2) and may reflect the level of adherence to infection control (IC) policies (3,4). Despite availability of guidelines for SSI prevention, compliance among healthcare workers remains suboptimal (1,2,5).

In Vietnam, 2 million patients undergo surgical procedures each year and SSI rates vary between 9.6%-17.9% (6-8). To our knowledge, this is the first study on the compliance with IC measures for SSI prevention in Vietnam. The purpose of this study is to evaluate compliance of surgical team members (STMs) and patients with some routine SSI control and prevention practices in four Vietnamese hospitals.

## METHODS

### Setting and sampling

General hospitals that provide surgical services in Vietnam

belong to one of the three tiers: national, provincial/municipal and district. Only national and provincial/municipal tiers of hospitals were included in this survey. The survey was sent to 109 hospitals across the country. Of these, 21 hospitals agreed to participate. From these, we randomly selected one hospital from each national and provincial/municipal tier. All of the hospitals in the mountainous regions of the country are included in the provincial tier. So we randomly selected two provincial hospitals, one from a mountainous area and one from the delta area. Altogether, four hospitals were randomly selected (lucky draw): one from the municipal tier (Pho Noi hospital, hereafter denoted as *hospital A*), one from the national tier (Bach Mai hospital hereafter denoted as *hospital B*), and two from the provincial tier (Ninh Binh and Yen Bai hospitals, hereafter denoted as *hospitals C* and *hospital D*). The bed size of the participating hospitals ranged from 462 to 1,900 hospital beds and from 95 to

## Acknowledgements

We thank the IC teams from the participating hospitals who contributed to the data collection and management of this study.

156 surgical beds; the average number of surgical procedures per year ranged from 3,500 to 14,688.

To evaluate surgical patient preparation at the participating hospitals, we recruited 568 elective surgical patients between November 2009 and February 2010. Direct observations of IC practices were rotated on every operating room (OR) of each hospital to verify compliance of different surgical teams. A total of 279 observation sessions were conducted during the study period.

This study was reviewed and approved by the Ethics and Health Research Review Committee of the Vietnamese Ministry of Health in September 2009. All patients were asked to sign a written informed consent sheet to participate in the study.

### **Study design**

An observational survey was conducted to identify the elective surgical patients and STMs and examine IC practices aimed at SSI prevention at the participating hospitals. All types of surgery were included (except for emergency surgical procedures).

### **Study materials**

Our survey forms were prepared by a team of IC experts, including a surgeon and developed based on the current CDC and WHO guidelines (9,10).

The first survey form about the preoperative surgical patient preparation consisted of two sections including (1) the methods of preoperative hair removal and (2) the methods of preoperative showering.

The second survey form about the compliance of STMs consisted of two additional sections including (1) compliance with surgical hand preparation and (2) compliance with the use of surgical attire.

For evaluation of each section our research group was convened to review the guidelines, the experiences of clinicians, and the resources for basic SSI prevention. We reached consensus on five items where strict compliance is required for SSI prevention. Where consensus could not be reached (e.g., relationship between the wearing of nail polish by surgical team members and SSI risk), items were excluded from the survey.

### **Evaluation of the preoperative showering methods**

Appropriate items about preoperative showering included (1) patient showered at least on the night prior to surgery, AND (2) showering was done with water provided by the hospital water treatment services, AND (3) skin antiseptic agent containing iodophors, chlorhexidine gluconate or alcohol based solutions was applied for showering, AND (4) patient was provided an instruction explaining showering procedure, AND (5) showering was taken in the designated area of participating hospitals (9). Preoperative showering was considered inappropriate if it did not meet the criteria for any of these five items.

### **Evaluation of the preoperative hair preparation**

Hair preparation methods were considered appropriate if (1) the hair at or around the incision site interfered with the operation, AND (2) clippers or scissors were used to cut the hair off at

the skin's surface, AND (3) hair was removed immediately before surgery, AND (4) hair removal was performed in the preoperative holding area, AND (5) hair removal was done by surgical nurses. Instances where hair removal was not required were counted towards appropriate practice compliance (9). Hair removal was considered inappropriate if it did not meet the criteria for any of the aforementioned five items.

### **Evaluation of the compliance of STMs with surgical hand preparation and the use of surgical attire in ORs**

Surgical hand preparation was defined as appropriate if (1) rings, watches, and bracelets were removed before beginning surgical hand preparation, AND (2) hands and forearm were scrubbed for at least three minutes, AND (3) brushless surgical hand scrub was performed, AND (4) all the scrub steps of surgical hand technique were followed (10), AND (5) hands and forearm were dried using a sterile cloth towels before putting gown and gloves on (10). Surgical hand preparation was considered inappropriate if it did not meet any of the above five criteria.

The compliance with the use of surgical attire in the OR was considered appropriate if (1) surgical fluid-resistant or impermeable shoe cover/boots were worn, AND (2) a cap/hood fully covered head hair, AND (3) a surgical mask fully covered nose and mouth, AND (4) a scrub suit consisting of pants and a short-sleeve shirt was worn, AND (5) indications for wearing or not wearing non-sterile single-use gloves according to WHO guidelines were followed (10). Surgical attire use was considered inappropriate if it did not meet any of the above five criteria.

### **Data collection**

Survey form for preoperative patient preparation: we collected data on patient characteristics (age, sex, surgery type, and wound class and American Society of Anesthesiology (ASA) physical status score), methods and timing of preoperative hair removal and showering for all elective surgical patients by trained surveillance team from each hospital comprising an IC practitioner and a surgical nurse. The data were transcribed from patient charts and recorded through direct interviews with the recruited patients.

Survey form for the compliance of STMs with routine IC practices: data were collected by two IC practitioners from each participating hospital through direct observations of STMs' practices. One IC practitioner was responsible for observing the compliance of STMs with surgical hand preparation. The other was in charge of observing STM turns that were defined as entries to or exits from the OR during surgical procedure. Observation sessions were conducted in the mornings and afternoons, with 2-4 observation sessions per day. Each session was taking place in an OR from the beginning to the end of an elective surgical procedure. Completed data collection forms were checked for accuracy and completeness at the end of the survey day by the principal investigator and the IC practitioner from the participating hospital.

**TABLE 1: Median score and correlates of preoperative hair and showering preparation**

Variable	No. of patients (n = 568)	Preoperative hair preparation			Preoperative showering preparation		
		Median (Minimum-Maximum) (Maximum score: 5)	P*	P**	Median (Minimum-Maximum) (Maximum score: 5)	P†	P‡
<b>Age group</b>							
< 18	49	5.0 (1.0-5.0)	> 0.05	> 0.05	0 (0-3.0)	< 0.01	< 0.05
18 – 39	149	5.0 (0-5.0)			2.0 (0-4.0)		
40 – 59	225	5.0 (0-5.0)			3.0 (0-4.0)		
> 60	145	5.0 (0-5.0)			2.0 (0-4.0)		
<b>Gender</b>							
Male	304	5.0 (0-5.0)	> 0.05	> 0.05	2.0 (0-4.0)	> 0.05	> 0.05
Female	264	5.0 (0-5.0)			3.0 (0-4.0)		
<b>Hospital</b>							
A	43	5.0 (1.0-5.0)	< 0.01	< 0.01	0 (0-3.0)	< 0.01	< 0.01
B	185	5.0 (0-5.0)			3.0 (0-3.0)		
C	201	5.0 (0-5.0)			0 (0-4.0)		
D	139	5.0 (4.0-5.0)			3.0 (0-3.0)		
<b>Ward</b>							
Surgery	496	5.0 (0-5.0)	< 0.01	< 0.01	2.0 (0-4.0)	> 0.05	> 0.05
Obstetric-gynecologic	72	5.0 (0-5.0)			2.0 (0-4.0)		
<b>Wound class</b>							
Clean	206	5.0 (0-5.0)	> 0.05	> 0.05	1.0 (0-4.0)	> 0.05	> 0.05
Clean-contaminated	263	5.0 (0-5.0)			2.0 (0-4.0)		
Contaminated	66	5.0 (0-5.0)			2.0 (0-3.0)		
Dirty	33	5.0 (0-5.0)			2.0 (0-4.0)		
<b>ASA score*</b>							
1	412	5.0 (0-5.0)	> 0.05	> 0.05	2.0 (0-4.0)	> 0.05	> 0.05
2	63	5.0 (1.0-5.0)			1.0 (0-3.0)		
≥ 3	93	5.0 (0-5.0)			3.0 (0-4.0)		
<b>Total</b>		<b>5.0 (0-5.0)</b>			<b>2.0 (0-4.0)</b>		

† P values obtained in Wilcoxon rank sum test for two dichotomous variables and Kruskal - Wallis test for variables had ≥ three levels

‡ P values obtained in linear regression analyses

\*American Society of Anesthesiologists (ASA) physical status score

Variables included in a linear regression analyses: hospital, ward, wound class, and ASA score

### Statistical analyses

Analyses were performed using SPSS. The following four measures of survey items were calculated: (1) a score of 1 or 0 was assigned for each appropriate or inappropriate survey item, respectively; (2) the maximum total score was calculated; (3) the scaled score was calculated by adding up assessment scores of the five items. To describe the STM turns (entries/exits to/from the OR during surgical procedure), the mean number of door opening throughout the procedure was calculated by number of turns, divided by total number of procedures. We compared differences in median scores by using Wilcoxon rank sum test for dichotomous variables and Kruskal-Wallis test for variables that had three or more levels. All factors with a p value of less than 0.1 were included in a linear regression analyses to compute the correlation between a scaled score and the variables studied (i.e., age, sex, hospital, professional activity, ward, surgery type, wound class). All reported p-values are two-sided and p-value <0.05 is considered statistically significant.

## RESULTS

### Preoperative patient preparation

A total of 568 elective surgical patients were interviewed in the four surveyed hospitals. Among them, 304 (53.5%) were

male and 264 (46.5%) were female, with median age of patients being 48 years (range 13-89).

Of 568 patients, 326 (57.4%) had a preoperative shower. For survey items about preoperative showering method, only small number of appropriate practices were observed: none of the patients had a shower with antiseptic agent, 54 (16.6%) were provided oral instructions by surgical nurses, 187 (57.4%) had a shower that was taken in the designated area of participating hospitals, 266 (81.6%) had a shower with water provided by the hospital water treatment services, and 292 (89.6%) had a shower the night prior to surgery.

The median score for preoperative showering was low 2.0 (0 - 4.0) compared with the maximum total score of five. After controlling for covariates through linear regression analyses, the median score of showering methods varied substantially from facility to facility (Table 1).

The overall rate of patients who had hair removed was 21.5% (122 of 568 patients). Of these, 74 (60.7%) patients had hair removed at or around the incision site if it interfered with the operation, 71 (58.2%) used clippers, 74 (60.7%) had hair removed immediately before surgery, 64 (52.5%) had it done in the preoperative holding area.

The median score for hair removal was 5.0 (0 - 5.0). Our findings show that there was a correlation of the hair removal means score with hospital and ward specialty (P < 0.01) (Table 1).

**TABLE 2: Median score and correlates of surgical hand hygiene**

Variable	No. of STMs* (n = 864)	Median (Minimum-Maximum) (Maximum score: 5)	P†	P‡
<b>Hospital</b>				
A	118	0 (0 – 3.0)	< 0.01	< 0.01
B	232	1.0 (0 – 4.0)		
C	425	2.0 (0 – 3.0)		
D	89	4.0 (3.0 – 4.0)		
<b>Professional activity</b>				
Anesthesiologist	190	1.0 (0 – 3.0)	< 0.01	> 0.05
Surgeon assistant	212	2.0 (0 – 4.0)		
Surgeon	462	2.0 (0 – 4.0)		
<b>Ward</b>				
Anesthesiology	5	1.0 (0 – 2.0)	> 0.05	> 0.05
Surgery	556	2.0 (0 – 4.0)		
Obstetric-gynecologic	303	2.0 (0 – 4.0)		
<b>Total</b>	<b>864</b>	<b>2.0 (0 – 4.0)</b>		

\*Surgical team member

† P values obtained in Wilcoxon rank sum test for two dichotomous variables and Kruskal - Wallis test for variables had ≥ three levels

‡ P values obtained in linear regression analyses

Variables included in a linear regression analyses: hospital, professional activity, and ward

### Compliance of STMs with surgical hand preparation and use of surgical attire in ORs

A total of 864 STMs who performed surgical hand hygiene and 5,509 turns of STMs were observed in the four participating hospitals. The mean number of times the OR door was opened throughout the procedure was 19.8 (5,509/279). Nurses and medical students were the most frequent individuals to enter/exit the OR with the mean number of door openings at 10.2 (2,826/279).

Of the 864 STMs, none complied with all survey items about surgical hand preparation. Appropriate practices were less frequent for at least three-minute scrubs with antiseptic agent (145, 16.8%) and brushless surgical hand scrubs (199, 23.0%). Survey items about scrub steps and hands and forearm dryness were correctly done by 523 (60.5%) and 538 (62.3%) of STMs, respectively. Almost all STMs (815, 94.3%) removed rings, watches, and bracelets before beginning surgical hand preparation.

The median score for surgical hand hygiene was low 2.0 (0 - 4.0) compared with the maximum total score of 5.

The survey showed that there was a significant association between the surgical hand preparation median score with occupation and hospitals (Table 2).

Compliance with surgical attire varied considerably, and was highest for wearing shoe covers/boots (5,500, 99.8%), followed by appropriate use of surgical mask (4,311, 78.2%), appropriate use of cap/hood (4,315, 78.3%), appropriate use of gloves (4,650, 84.4%), and wearing scrub suits (2,582, 46.9%). Full compliance of STMs with surgical attire was only 37.8%.

The rates of STM turns complying with appropriate use of scrub suits in hospitals C, D, and A were only 4.0%, 17.0%, and 44.0%, respectively. Only 62.7% of STM turns in hospital C correctly worn surgical mask. The rates of STM turns complied with correct use of cap/hood were only 60.9% in hospital C and 63.5% in hospital A.

Cross-hospital comparisons showed significant differences for surgical attire compliance. Compliance was also significantly influenced by professional activity. Anesthesiologists had a significantly higher median score than did other professional activities (Table 3).

**Table 3:** Median score and correlates of surgical attire use

Variable	No. of STM turns* (n = 5,509)	Median (Minimum-Maximum) (Maximum score: 5)	P†	P‡
<b>Hospital</b>				
A	457	4.0 (1.0 – 5.0)	< 0.01	< 0.01
B	2,373	5.0 (0 – 5.0)		
C	2,432	3.0 (1.0 – 5.0)		
D	247	4.0 (0 – 5.0)		
<b>Professional activity</b>				
Anesthesiologist	851	5.0 (0 – 5.0)	< 0.01	< 0.01
Surgeon assistant	263	4.0 (1.0 – 5.0)		
Surgeon	1,001	4.0 (1.0 – 5.0)		
Nurse	1,975	4.0 (1.0 – 5.0)		
Nurse assistant	640	4.0 (1.0 – 5.0)		
Medical student	779	3.0 (1.0 – 5.0)		
<b>Ward</b>				
Surgery	3,072	4.0 (0 – 5.0)	< 0.01	< 0.01
Obstetric-gynecologic	1,808	4.0 (0 – 5.0)		
Anesthesiology	629	4.0 (1.0 – 5.0)		
<b>Total</b>	<b>5,509</b>	<b>4.0 (0 – 5.0)</b>		

\*Surgical team member turns

† P values obtained in Wilcoxon rank sum test for two dichotomous variables and Kruskal - Wallis test for variables had ≥ three levels

‡ P values obtained in linear regression analyses

Variables included in a linear regression analyses: hospital, professional activity, and ward



## DISCUSSION

We found significant gaps between the practices recommended in the guidelines and the actual compliance with SSI prevention practices at the point of care. Despite evidence that an antiseptic shower the night before operation reduces skin microflora and decreases the risk of SSI (1,9), our findings showed that only 326 (57.4%) of the interviewed patients had a shower. Insufficient availability and limited access to showering facilities and antiseptic agent with a broad spectrum of activity and a rapid onset were the main reasons for the poor compliance of our patients. Provision of education and better institutional financial support could improve the compliance with preoperative showering.

Our study revealed inappropriate preoperative hair removal practices, which were similar to that reported in previous studies in developing countries (4). Among the patients who had hair removed, approximately half had them shaved with a razor – a practice known to result in razor injuries contributing to microbial contamination of the surgical site and increased risk of SSIs (4,9). The long-standing tradition of shaving surgical sites by patients is still very popular in Vietnamese health care facilities. The lack of surgical nurses could be an issue as well. Patients often remove their hair unsupervised by the surgical nurses.

Our findings emphasize the need for further studies on the effect of continuing intensive education combined with appropriate staffing and provision of facilities for basic SSI prevention on compliance with SSI control and prevention practices.

Our study also found that the mean number of door openings into ORs was 19.8. This is consistent with previous research which found a large number of entries/exits in the OR during the operation (1), mostly by anesthesiologists, nurses and medical students. Thus, a revision of the ergonomics in workplace could be an important way to limit STM turns during the operation.

Hand hygiene is one of the most important components of any SSI control and prevention strategy (12). However, we found poor surgical hand hygiene practices in participating hospitals. No STM fully complied with surgical hand preparation, which resulted in a small median score of 2.0 (0 - 4.0) for this survey item. The most frequent inappropriate practices were forearm and hand scrub using brushes and surgical scrub less than three minutes. Implementation of a multimodal and multidisciplinary strategy including education, leadership engagement, and peer pressure and role models would be important interventions to improve surgical hand hygiene compliance (11). Among participating hospitals, surgical hand preparation with waterless, alcohol-based hand rub (ABHR) that improves compliance hand hygiene (10,12) was only practiced in hospital D. Use of ABHR is less time-consuming and more effective against microorganisms. Furthermore, ABHRs are recommended when quality of water is ambiguous (10,12,13). Poor water quality control remains a problem at all levels of Vietnamese healthcare facilities. We recommend a switch from surgical handwashing to surgical handrubbing to improve compliance with surgical hand hygiene in Vietnam.

In ORs, the use of non-sterile surgical attire is important in minimizing the risk of microbial contamination of the operating site from the theatre environment (14). Wearing surgical attire is also needed to maintain theatre discipline and may therefore contribute to a reduced risk of SSI. Inappropriate use of surgical attire was common in this study. Only 37.8% of observed STMs correctly used surgical attire including scrub suits, mask, cap/hood, shoe covers/boots, and gloves. We found the lower median score for surgical attire use in provincial hospitals (hospitals A, C, and D) where institutional support for the purchase of personal protective equipment (PPE) was limited. Medical students were less likely to comply with surgical attire use in the ORs. Our finding suggests that a combination of strategies including continuous education in IC, easy accessibility to PPE may help address this issue.

This study has several limitations. It did not evaluate the compliance with the use of sterile surgical attire including fluid-resistant or impermeable gown and sterile gloves. The study was conducted in only four hospitals with some fields of practice not included in the analysis, thus limiting the generalisability of our findings.

## REFERENCES

1. Castella, A., et al., *Surgical site infection surveillance: analysis of adherence to recommendations for routine infection control practices*. *Infect Control Hosp Epidemiol*, 2006. 27(8): p. 835-40.
2. Eskicioglu, C., et al., *Surgical site infection prevention: a survey to identify the gap between evidence and practice in University of Toronto teaching hospitals*. *Can J Surg*, 2012. 55(4): p. 233-8.
3. Awad, S.S., *Adherence to surgical care improvement project measures and post-operative surgical site infections*. *Surg Infect (Larchmt)*, 2012. 13(4): p. 234-7.
4. Adisa, A.O., O.O. Lawal, and O. Adejuyigbe, *Evaluation of two methods of preoperative hair removal and their relationship to postoperative wound infection*. *J Infect Dev Ctries*, 2011. 5(10): p. 717-22.
5. Ganczak, M. and Z. Szych, *Surgical nurses and compliance with personal protective equipment*. *J Hosp Infect*, 2007. 66(4): p. 346-51.
6. Nguyen, D., et al., *Incidence and predictors of surgical-site infections in Vietnam*. *Infect Control Hosp Epidemiol*, 2001. 22(8): p. 485-92.
7. Le, T.A., et al., *Microbiology of surgical site infections and associated antimicrobial use among Vietnamese orthopedic and neurosurgical patients*. *Infect Control Hosp Epidemiol*, 2006. 27(8): p. 855-62.
8. *Vietnam Ministry of Health Minimum Health Data Set*. Vietnam Health Statistics and Informatic Division, 1993-1996.
9. Mangram, A.J., et al., *Guideline for prevention of surgical site infection, 1999*. *Hospital Infection Control Practices Advisory Committee*. *Infect Control Hosp Epidemiol*, 1999. 20(4): p. 250-78; quiz 279-80.
10. *WHO Guidelines on Hand Hygiene in Health Care*. 2006: p. 51-87.
11. Zingg, W., et al., *Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus*. *Lancet Infect Dis*, 2015. 15(2): p. 212-224.
12. Widmer, A.F., *Replace hand washing with use of a waterless alcohol hand rub?* *Clin Infect Dis*, 2000. 31(1): p. 136-43.
13. Salmon, S., et al., *Health care workers' hand contamination levels and antibacterial efficacy of different hand hygiene methods used in a Vietnamese hospital*. *Am J Infect Control*, 2014. 42(2): p. 178-81.
14. Davis, P.J., D. Spady, and S.E. Forgie, *A survey of Alberta physicians' use of and attitudes toward face masks and face shields in the operating room setting*. *Am J Infect Control*, 2007. 35(7): p. 455-9. \*

## OUTBREAK INVESTIGATION

# Spatio-temporal analysis of *Acinetobacter baumannii* outbreak with multiple routes of transmission in ICU setting

Fondrinier Caroline<sup>1</sup>, Mouet Audrey<sup>1</sup>, Borgey France<sup>2</sup>, Fines-Guyon Marguerite<sup>3</sup>, Pornet Carole<sup>1</sup>, Cattoir Vincent<sup>3</sup>, Le Coutour Xavier<sup>1</sup>

<sup>1</sup>CHU de Caen, Service hygiène hospitalière, Avenue de la Côte de Nacre, F-14033 Caen Cedex, France

<sup>2</sup>Antenne Régionale de Lutte contre les Infections Nosocomiales (ARLIN) de Basse-Normandie, CHU de Caen, Avenue de la Côte de Nacre, F-14033 Caen Cedex, France.

<sup>3</sup>CHU de Caen, Service de microbiologie, Avenue de la Côte de Nacre, F-14033 Caen Cedex, France.

Corresponding author: **Caroline Fondrinier**

Service hygiène hospitalière

CHU de Caen

Avenue de la côte de nacre

14000 Caen, France

Tel : +33685674973

c.fondrinier@gmail.com

## ABSTRACT

An imipenem-resistant *Acinetobacter baumannii* (IRAB) outbreak occurred in five different hospital units after a patient repatriated from Romania was not screened on admission. Due to persistent nature of *A. baumannii* as a hospital pathogen and multiple vectors of transmission, robust infection control measures had to be put in place from the onset of the index case.

## INTRODUCTION

*Acinetobacter baumannii* is an opportunistic pathogen that is responsible for outbreaks primarily in intensive care units and burn departments (1). This Gram-negative pathogen, which is naturally present in the environment in various environmental locations (animals, vegetables, soil etc.) (2) has in recent years developed high level resistance to  $\beta$ -lactams including imipenem, thus limiting therapeutic options and leading to high mortality (3). It is also a hardy microorganism able to withstand and survive desiccation on inert surfaces for several months. These two characteristics make this pathogen particularly dreaded in hospitals (4,5). The major route of transmission of *A. baumannii* is through hands, with poor hand hygiene compliance being a known risk factor for the spread of the organism (6).

Several reports have already described hospital outbreaks involving *A. baumannii* and put forward theories about cross-transmission (7,8). Our study investigates how such cross-transmission may have occurred, how we could have avoided this outbreak and been more efficient in controlling it.

## METHODS

### Definition

The outbreak occurred in a 1,660-bed University Hospital with two surgical intensive care units (SICUs A and B) and in a

medical intensive care units (MICU). A case was defined as a hospitalized patient for whom a clinical or screening sample was positive for *A. baumannii* with the same susceptibility panel as that of the index case. We defined the epidemic phase as the time when there were at least two cases (person) in the same geographic location (place) over 48 hours (time).

### Description of the outbreak

Acute phase of the outbreak occurred from February to late March 2013 (Figures 1 and 2). On February 6, two imipenem-resistant *A. baumannii* (IRAB) cases were reported in SICU A (cases 2 and 3). The index case (case 1) was a 37-year-old man repatriated from an ICU in Romania and admitted on January 25. Screening detected IRAB, vancomycin-resistant enterococcus (VRE) and methicillin-resistant *Staphylococcus aureus* (MRSA). All patients in SICU A were then placed under contact precautions and screened every three days for IRAB and VRE. Reminders were issued about the importance of control measures, focusing on hand hygiene and the need for high quality cleaning and disinfection of rooms (9). All patient rooms on the affected units were cleaned and disinfected twice a day.

On 20 February, case 4 was reported in SICU A, at which point it was decided that this unit would become a cohorting unit. On 22 February, two new cases were reported (cases 5 and 6). Case 5 was already present in SICU B and case 6

## Acknowledgements

The authors thank all SICU and MICU staff for their collaboration in the management of this outbreak.

**TABLE 1:** Cross-transmission investigations.

Cases	Investigations	Possibility of cross-transmission
<b>Case 2</b>	Patients in the rooms adjacent case 1	Hand transmission by health care workers
<b>Case 3</b>		
<b>Case 4</b>		
<b>Case 5</b>	Patient in the former room of case 10	Environmental persistence of IRAB
<b>Case 6</b>	Common equipment, cross-functional team and visitor in SICU and MICU	Hand transmission
<b>Case 7</b>	Patient with several risk factor (invasive medical devices and antibiotic pressure)	Low level persistence of IRAB in MICU's ecology
<b>Case 8</b>	Follow case 2 on technical platform in February	Environmental persistence of IRAB
<b>Case 9</b>	Follow case 7 in an operative room in February	Environmental persistence of IRAB

was hospitalized in MICU. Both patients were transferred to the cohorting unit. The cohorting unit and contact precaution measures were discontinued on March 15. However, three sporadic cases occurred from May 2013 to July 2013 in MICU, orthopedic and urology wards; so measures taken during the acute phase were reactivated.

### Investigations

The microbiology department isolated all strains from clinical specimens and screening samples on selective agar (Brilliance CRE, Oxoid). Since antimicrobial susceptibility results were identical, the strains were compared by the rep-PCR method with the *Acinetobacter spp* kit (DiversiLab®, bioMérieux) as per the supplier's recommendations. Rectal and oropharyngeal swabs were taken to increase sensitivity (10).

To determine the different routes of transmission, all patients' itineraries were reconstructed, examined in detail and cross-referenced. We examined all surgical procedures and radiographic exams, compared occupation of rooms for all cases, and checked the use of common hospital equipment. We compared the schedules of all interventions in ICU where physiotherapists and other cross-functional teams or specialists were involved.

To find potential contact patients who might have carried the pathogen from one unit to another, the hospital's medical information systems was deployed to examine the lists of all patients and trace their movements across the hospital units. Visitors' itineraries were also investigated through interviews conducted by the hospital staff.

We conducted environmental investigation by swabbing designated high-touch surfaces (bedside tables, bedrails, door handles, and mattresses) and sinks in patient rooms, as well as medical and office equipment on the affected units, looking for an environmental reservoir of the pathogen. For environmental sample collection we used sterile cotton swabs

pre-moistened in normal saline that were rubbed back and forth three times over each surface. The swabs were applied on Drygalski agar with 2mg/L of imipenem, at 37°C during 48h. The sampling plan was made by analyzing the risk of contamination of different parts of the patient rooms.

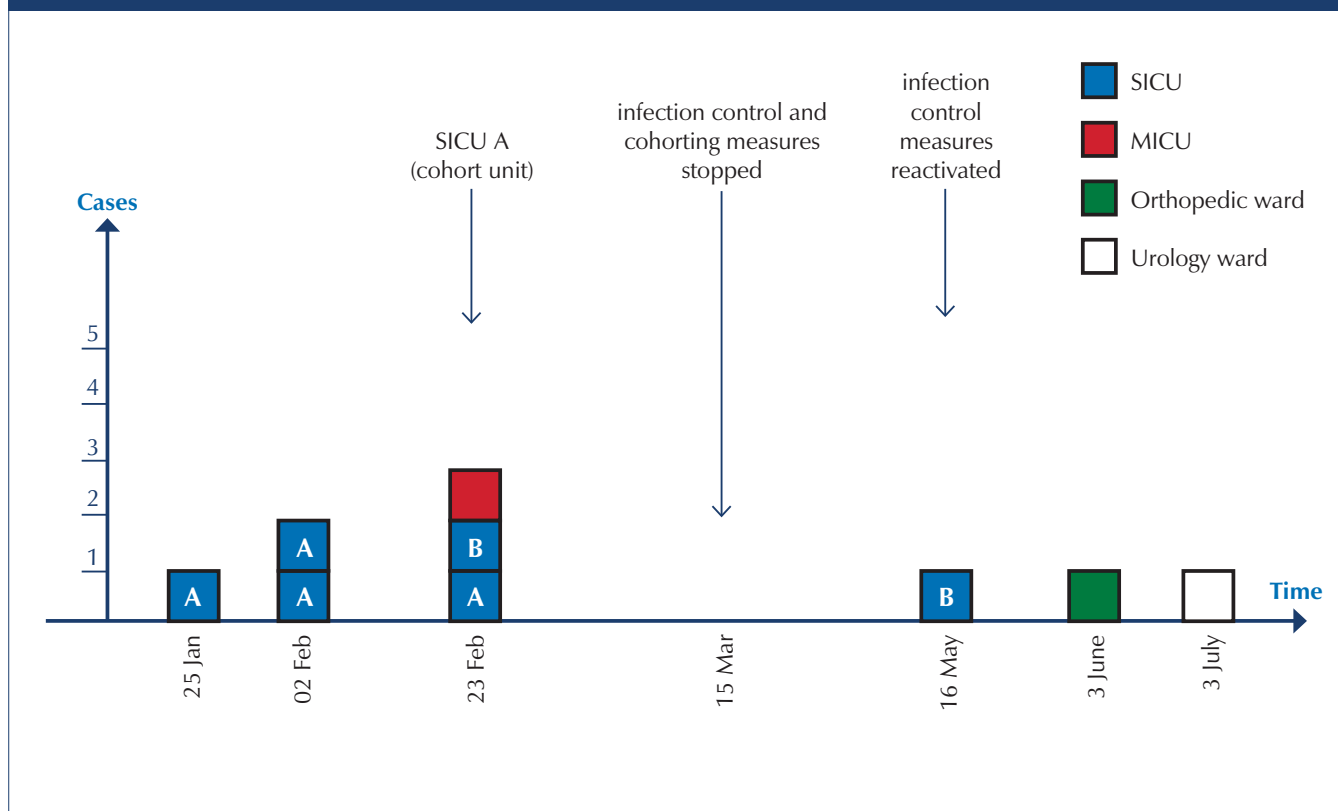
### RESULTS

Over the course of four months, 10 cases (eight clinical infections and two cases of colonization) were reported from five different units. The rep-PCR technique confirmed the clonality of nine of these strains. Case 10 was a patient transferred from our facility to another hospital where he was screened, and included into our case count retrospectively. Cases 2 and 3 were located in two rooms adjacent to case 1. Hand transmission by healthcare workers seems to be the most likely route of transmission, as with Case 4, who was also hospitalized in this unit. Case 5 was detected in the room previously occupied by a patient later recognized as an IRAB case (Case 10). Environmental contamination might have been a likely source in the emergence of this case, with inadequate cleaning and environmental disinfection as contributing factors.

Case 6 detected in MICU was separated from the rest of the affected units by ten hospital floors. However, we identified a visitor to MICU who also happened to spend some time at SICU A. When patient logs and itineraries were analyzed, it became apparent that Case 2, who was hospitalized in SICU A, had her husband hospitalized at the same time in MICU. The healthcare teams confirmed that their children had come to visit them on several occasions thus likely contributing to cross-transmission of the pathogen between the units.

Case 7 had multiple risk factors and developed a clinical IRAB infection while hospitalized in the SICU. Case 8 was a roommate of Case 2, which might have contributed to transmission.

FIGURE 2: Synoptique curve



Case 9, reported on July 2013 was traced back to an operating room where he had a surgical procedure on 15 February 2013, only hours after Case 7 was operated in the same room. We hypothesize that environmental contamination might have played a role in this episode of transmission, though all subsequently collected environmental samples tested negative.

The common routes of cross-transmission were suspected (but never confirmed through lab cultures) to be hand transmission by healthcare workers and visitors, and transmission through environmental fomites (Table 1).

## DISCUSSION

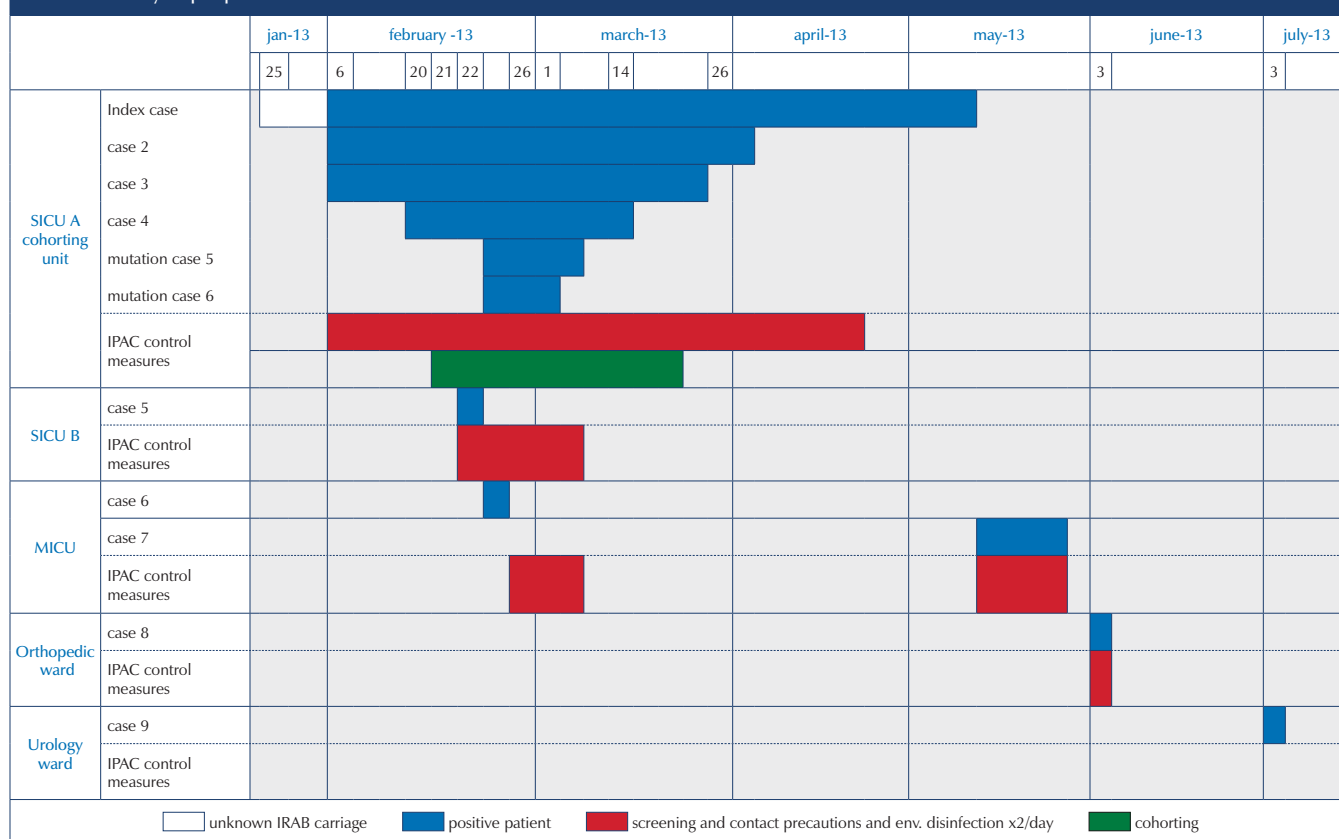
The outbreak unfolded in two stages; first with seven cases over the course of 15 days and then the second phase with three cases spread over three months. Our control measures were not effective enough to curb the spread of IRAB early in the outbreak. The potential for cross-transmission by visitors and staff working across the facility was underestimated and could explain part of the caseload and distribution of cases between five different units.

Cleaning and disinfection are essential in the control of outbreaks of *A. baumannii*, and the role of environmental surfaces as sources of hand contamination and re-contamination, cannot be underestimated (11,12). Environmental surfaces are epidemiologically important reservoir for this pathogen, second only to hands of healthcare personnel, so to avoid any resurgence of infection thorough cleaning and disinfection are a must (13).

All rooms on the affected units were environmentally screened before being re-opened. Any instance of the pathogen isolated from an environmental screen was regarded as a proxy marker for suboptimal quality of environmental cleaning and disinfection.

One of the key lessons learned from our experience was importance of instituting intensive control measures immediately following identification of the index case. Current best practice guidelines in France recommend only contact precautions for IRAB both in ICUs and in other care settings. In our opinion, in ICU settings contact precautions alone are insufficient. Our experience shows that IRAB has a significantly stronger epidemic propensity than VRE and can carry a greater risk of serious infection. For a more effective control of cross-transmission, patients with a lab-confirmed IRAB should be placed in single rooms, with dedicated nursing personnel, as is currently recommended for VRE and CPE. Cho et al. suggested that cohorting patients colonized or infected with IRAB had a significant impact on reducing the transmission (14). Infection control measures should subsequently be modified according to the outcome of the case, contact screening and a risk analysis of cross-transmission. The latter should include a minimal assessment of infection control measures, monitoring of the volumes of alcohol-based hand rub utilization and the health care team's experience in managing multidrug-resistant pathogens.

FIGURE 2: Synoptique curve



Given the persistent nature of *A. baumannii* as a hospital pathogen and its multiple routes of transmission, various national and international recommendations on control measures to prevent its spread have been issued (15,16). The efficiency of these outbreak control measures is better when they are applied in a multidisciplinary team approach and early in the outbreak, ideally when the index case has been identified.

## REFERENCES

- Zanetti G, Blanc DS, Federli I, et al. Importation of *Acinetobacter baumannii* into a burn unit: a recurrent outbreak of infection associated with widespread environmental contamination. *Infect Control Hosp Epidemiol Off J Soc Hosp Epidemiol Am* 2007; 28:723–725.
- Eveillard M, Kempf M, Belmonte O, et al. Reservoirs of *Acinetobacter baumannii* outside the hospital and potential involvement in emerging human community-acquired infections. *International journal of infection diseases* 2013; 17:802-805.
- Choi WS, Kim SH, Jeon EG, et al. Nosocomial outbreak of carbapenem-resistant *Acinetobacter baumannii* in intensive care units and successful outbreak control program. *J Korean Med Sci* 2010;25:999–1004.
- Peleg AY, Seifert H, Paterson DL. *Acinetobacter baumannii*: emergence of a successful pathogen. *Clin Microbiol Rev* 2008;21:538–582.
- Kramer A, Schwebke G, Kampf G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. *BMC Infect Dis* 2006;6:130-136.
- Otter JA, Yezli S, French GL. The role played by contaminated surfaces in the transmission of nosocomial pathogens. *Infect Control Hosp Epidemiol Off J Soc Hosp Epidemiol Am* 2011;32: 687–699.
- Montefour K, Frieden J, Hurst S, et al. *Acinetobacter baumannii*: an emerging multidrug-resistant pathogen in critical care. *Crit Care Nurse* 2008; 28: 15–25.
- Consales G, Gramigni E, Zamidei L, Bettocchi D, De Gaudio AR. A multidrug-resistant *Acinetobacter baumannii* outbreak in intensive care unit: antimicrobial and organizational strategies. *J Crit Care* 2011;26:453–459.
- La Forgia C, Franke J, Hacek DM, Thomson RB Jr, Robicsek A, Peterson LR. Management of a multidrug-resistant *Acinetobacter baumannii* outbreak in an intensive care unit using novel environmental disinfection: a 38-month report. *Am J Infect Control* 2010;38:259–263.
- Consensus formalisé d'experts. Recommandations nationales : prévention de la transmission croisée: précautions complémentaires contacts. *Hygiènes* 2009;volume XVII n°2, p121-126.
- Lu PL, Siu LK, Chen TC, et al. Methicillin-resistant *Staphylococcus aureus* and *Acinetobacter baumannii* on computer interface surfaces of hospital wards and association with clinical isolates. *BMC Infect Dis* 2009;9:164-170.
- Bures S, Fishbain JT, Uyehara CF, Parker JM, Berg BW. Computer keyboards and faucet handles as reservoirs of nosocomial pathogens in the intensive care unit. *Am J Infect Control* 2000;28:465–471.
- Bourigault C, Corvec S, Bretonnière C, et al. Investigation and management of multidrug-resistant *Acinetobacter baumannii* spread in a French medical intensive care unit: one outbreak may hide another. *Am J Infect Control* 2013;41:652-653.
- Cho OH, Bak MH, Baek EH, Park KH, Kim S, Bae IG. Successful control of carbapenem-resistant *Acinetobacter baumannii* in a Korean university hospital: A 6-year perspective. *Am J Infect Control* 2014; 42: 976-979.
- Siegel JD, Rhinehard E, Jackson M, Chiarello L. Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in healthcare settings 2006.2010.
- HCSF. Prévention de la transmission croisée des Bactéries Hautement Résistantes aux antibiotiques émergentes (BHRe). Haut Conseil de la Santé Publique. Juillet 2013;18-23. 🌸

## CONCISE REPORT

# Device-associated infection rates, bacterial resistance, length of stay, and mortality in intensive care units of Costa Rica: Findings of the International Nosocomial Infection Control Consortium (INICC)

Olber Chavarria Ugalde,<sup>1</sup> Rosalia Fernandez Hidalgo,<sup>2</sup> Victor D. Rosenthal,<sup>3</sup> Ivar Calvo Hernandez,<sup>1</sup> Gabriel Munoz Gutierrez,<sup>2</sup> Carlos Gonzalez Fuentes,<sup>1</sup> Laura Maroto Vargas,<sup>2</sup> Antonio Solano Chinchilla,<sup>1</sup> Maria Adelia Zúñiga Chavarría,<sup>2</sup> Adela Arguello Ruiz<sup>2</sup>

<sup>1</sup>Hospital La Católica, San José de Costa Rica, Costa Rica.

<sup>2</sup>Hospital Clínica Bíblica, San José de Costa Rica, Costa Rica.

<sup>3</sup>International Nosocomial Infection Control Consortium (INICC), Buenos Aires, Argentina.

Corresponding author: **Victor Daniel Rosenthal**

11 de Septiembre 4567, Floor 12, Apt 1201. Buenos Aires, ZIP 1429, Argentina.

Phone: 54-9-11-5691-1775

E-mail address: victor\_rosenthal@inicc.org.

Website: www.inicc.org

## ABSTRACT

**Objective:** To report the results of the International Nosocomial Infection Control Consortium (INICC) study conducted in Costa Rica from April 2007 to April 2015.

**Methods:** A device-associated healthcare-acquired infection (DA-HAI) prospective surveillance study in two adult intensive care units (ICUs) from two hospitals applying CDC/NHSN's criteria and definitions, using INICC Online Surveillance System.

**Results:** Data was collected from 1,128 adult ICU patients over 4,055 bed-days. The central line-associated bloodstream infection (CLABSI) rate was 2.9 per 1,000 central line (CL)-days, the ventilator-associated pneumonia (VAP) rate was 30.7 per 1,000 mechanical ventilator (MV)-days, and the catheter-associated urinary tract infection (CAUTI) rate was 1.5 per 1,000 urinary catheter (UC)-days. The CLABSI rate was similar to INICC rates (4.9) and higher than CDC/NHSN rates (0.8), with a higher CL device utilization ratio (DUR). The CAUTI rate was lower than INICC's (5.3) and similar to CDC/NHSN's (1.3), with a lower UC DUR. Despite the VAP rate being higher than INICC (16.5) and CDC/NHSN's rates (1.1), MV DUR was lower in this study's ICUs.

Resistance rates of *S. aureus* to oxacillin and of *E. coli* to imipenem and meropenem were higher than INICC and CDC/NHSN's rates.

Excess length of stay was 11.2 days for patients with CLABSI and 13.6 for patients with VAP. Excess crude mortality was 25.6% for patients with VAP.

**Conclusions:** Most DA-HAI rates found in this study's ICUs are higher than CDC/NHSN's rates and similar to or higher than INICC rates.

## KEY WORDS

Hospital infection; device-associated infection; antibiotic resistance; ventilator-associated pneumonia; catheter-associated urinary tract infection; central line-associated bloodstream infections.

## INTRODUCTION

Device-associated healthcare-acquired infections (DA-HAIs) are among the primary threats to patient safety in the intensive care unit (ICU), and are responsible for substantial patient morbidity and mortality (1). Comprehensive infection control programs focused on DA-HAI surveillance have had effective results, as demonstrated in different studies conducted in the U.S. that stated the incidence of DA-HAI can be reduced by as much as 30%, and that a parallel reduction in healthcare costs was also possible (2).

In the same way, it is essential to address the burden of antimicrobial-resistant infections and report pathogens and susceptibility to antimicrobials of DA-HAI-associated pathogens, so that informed decisions can be made to effectively prevent transmission of resistant strains and their determinants, such as strains with phenotypes with very few available treatments with chances of success (3).

In the U.S., the Centers for Disease Control and Prevention's National Healthcare Safety Network (CDC/NHSN) (4) has provided benchmarking U.S. ICU data on DA-HAIs, which have

## Acknowledgements

The authors thank the many healthcare professionals at each member hospital who assisted with the conduct of surveillance in their hospital; Mariano Vilar and Débora López Burgardt; Haifaa Hassan Al-Mousa, Hail Alabdaley, Areej Alshehri, Altaf Ahmed, Carlos A. Álvarez-Moreno, Anucha Apisarnthanarak, Bijie Hu, Hakan Leblebicioglu, Yatin Mehta, Toshihiro Mitsuda, and Lul Raka; and members of the INICC Advisory Board who have so generously supported this unique international infection control network.

Potential conflicts of interest: All authors report no conflicts of interest related to this article. Every hospital's Institutional Review Board agreed to the study protocol, and patient confidentiality was protected by codifying the recorded information, making it only identifiable to the infection control team.

proven invaluable for researchers during more than 40 years, and served as an inspiration to the International Nosocomial Infection Control Consortium (INICC)(5).

Founded in Argentina in 1998, the INICC is an international non-profit, open, multi-centre, collaborative healthcare-associated infection control network with a surveillance system based on that of the CDC/NHSN (6). INICC is the first multinational surveillance and research network established to measure, control and reduce DA-HAI, and surgical site infections (SSIs) hospital wide through the analysis of data collected on a voluntary basis by a pool of hospitals worldwide (7, 8).

The INICC has the following goals: to create a dynamic global network of hospitals worldwide and conduct surveillance of DA-HAIs and SSIs using standardized CDC/NHSN definitions and established methodologies, to carry out applied infection control research and promote the implementation of evidence-based infection control practices; to provide surveillance tools and training to individual hospitals to conduct outcome and process surveillance of DA-HAIs and SSIs, measure their consequences, and assess the impact of infection control practices; to improve the safety and quality of healthcare world-wide through the implementation of systematized programs to reduce rates of DA-HAIs and SSIs, their associated mortality, excess lengths of stay (LOS), excess costs, antibiotic usage, and bacterial resistance (9). Surveillance is conducted by means of an online platform called INICC Surveillance Online System (ISOS) that comprises 15 modules, whose effective impact in DA-HAI rates reduction was shown in several studies (10-25).

The ISOS allows the classification of prospective, active, cohort surveillance data into specific module protocols that apply U.S. CDC/NHSN's definitions published in January 2015 (26). This report is a summary of data on DA-HAIs collected between April 2007 and April 2015 in 2 ICUs in two hospitals in Costa Rica that participate in the INICC (8).

## METHODS

### **Background on INICC**

INICC is comprised of more than 2,000 hospitals in 500 cities of 66 countries in Latin America, Asia, Africa, Middle East, and Europe, and has become the only source of aggregate standardized international data on the epidemiology of healthcare-associated infections (HAIs) internationally (5). The INICC is focused on the surveillance and prevention of DA-HAI in adult, pediatric ICUs and neonatal ICUs (NICUs), step down units, inpatient wards, and of SSIs in surgical procedures hospital wide.

### **Setting and study design**

This prospective cohort surveillance study was conducted in two medical/surgical ICUs from two hospitals in San José, Costa Rica, through the implementation of the INICC Multidimensional Approach (IMA), as described below. In accordance with the INICC's charter, the identity of all INICC hospitals and cities is kept confidential.

### **INICC multidimensional approach**

The IMA includes the implementation of CDC/NSHN's definitions of HAIs and methodology, but adds the collection of other data essential to increase ICPS's sensitivity of to detect HAIs, and avoid underreporting (6). According to standard CDC/NSHN methods, numerators are the number of HAIs of each type, and denominators are device-days collected from all patients, as pooled data; that is, without determining the number of device-days related to a particular patient, and without collecting features or characteristics per specific patient (6). This aspect differs from the INICC surveillance system, because the design of the cohort study through the INICC methods also includes collecting specific data per patient from *all* patients, both those with and those without HAI, collecting risk factors of HAIs, such as invasive devices, and surrogates of HAIs, which include, but are not limited to, high temperature, low blood pressure, results of cultures, antibiotic therapy, LOS and mortality. By collecting data on all patients in the ICU, it is possible to match patients with and without HAI by several characteristics to estimate extra LOS, mortality and cost.

The IMA comprises the simultaneous implementation of the following six components for HAI control and prevention: 1) a bundle of interventions; 2) education; 3) outcome surveillance; 4) process surveillance; 5) feedback on HAI rates and consequences; and 6) performance feedback.

Outcome and process surveillance are conducted by means of an online platform called INICC Surveillance Online System (ISOS). The ISOS comprises 15 modules: 10 for Outcome Surveillance and five for Process Surveillance. The modules of the outcome surveillance and process surveillance components may be used singly or simultaneously, but once selected; they must be used for a minimum of one calendar month.

This study presents the results of the Cohort Surveillance of HAIs in adult, pediatric and neonatal ICUs. The results of the remaining Outcome Surveillance modules (1) *C. difficile* infections (CDIs); 2) Antimicrobial Consumption; 3) Surveillance of Needle Stick Injuries, 4) Cohort Surveillance of HAIs in inpatient wards and step down units; 5) Cohort Surveillance of surgical procedures and surgical site infections] and of the modules for Process Surveillance, Feedback on HAI rates and consequences, and Performance Feedback were not included in this report, because they will be published in another future study.

### **Outcome surveillance**

Outcome surveillance included Cohort Surveillance of HAIs in adult ICUs conducted through the ISOS, which allows the classification of prospective, active, cohort surveillance data into specific module protocols that apply U.S. CDC/NHSN's definitions updated in 2015 (6). The site-specific criteria include reporting instructions and provide full explanations integral to their adequate application (6).

**TABLE 1:** Pooled means of the distribution of crude mortality, crude excess mortality, length of stay, and crude excess length of stay, of adult intensive care unit patients with and without device-associated healthcare-acquired infection

Patients	Patients, n	Deaths, n	Pooled crude mortality, %	Pooled crude extra mortality, % (95% CI)	LOS, total days	Pooled average. LOS, days	Pooled average. extra LOS, days (95% CI)
Without DA-HAI	1,086	41	3.8%	-	3,093	2,8	-
With CLABSI	6	0	0.0%	-	67	11.2	8.3 (5.9–11.2)
With VAP	34	10	29.4%	25.6% (12.4 - 42.4)	461	13.6	10.7 (9.6 - 11.9)

ICU, intensive care units; CI, confidence interval; DA-HAI, device-associated healthcare-acquired infection; CLABSI, central line-associated bloodstream infection; VAP, ventilator-associated pneumonia; CAUTI, catheter-associated urinary tract infection; LOS, length of stay; CI, confidence interval.

**Table 2:** Antimicrobial resistance rates in the participating intensive care units

	Pathogenic isolated tested, pooled, n	Resistance, %	Pathogenic isolated tested, pooled, n	Resistance, %	Pathogenic isolated tested, pooled, n	Resistance, %	Resistance, %
Pathogen, antimicrobial	(CLABSI)	(CLABSI)	(VAP)	(VAP)	(CAUTI)	(CAUTI)	(Pooled)
<i>S. aureus</i> Oxacillin	0	-	1	100%	0	-	100%
Coagulase-negative staphylococci Oxacillin	1	100%	0	-	0	-	100%
<i>P. aeruginosa</i> Ciprofloxacin	0	-	5	20%	0	-	20%
Piperacillin-tazobactam	2	50%	5	40%	1	0%	37.5%
Amikacin	0	-	0	-	5	40%	40%
Imipenem or meropenem	1	100%	0	-	8	50%	55.6%
<i>K. pneumoniae</i> Imipenem or meropenem	0	-	4	0%	0	-	0%
<i>A. baumannii</i> Piperacillin-tazobactam	0	-	1	0%	0	-	0%
Imipenem or meropenem	0	-	1	0%	0	-	0%
<i>E. coli</i> Imipenem or meropenem	0	-	2	50%	0	-	50%

CLABSI, central line-associated bloodstream infection; VAP, ventilator-associated pneumonia; CAUTI, catheter-associated urinary tract infection.



### Data collection and analysis

The ISOS follows the INICC protocol and infection control professionals (ICPs), who collected daily data on central line-associated bloodstream infections (CLABSIs), catheter-associated urinary tract infections (CAUTIs) and ventilator-associated pneumonias (VAPs) and denominator data, patient-days and specific device-days in the ICUs.

These data were uploaded to the ISOS, and were used to calculate DA-HAI rates per 1000 device-days, mortality and LOS, according to the following formulas: Device-days consisted of the total number of central line (CL)-days, urinary catheter (UC)-days, or mechanical ventilator (MV)-days. Crude excess mortality of DA-HAI equals crude mortality of ICU patients with DA-HAI minus crude mortality of patients without DA-HAI. Crude excess LOS of DA-HAI equals crude LOS of ICU patients with DA-HAI minus crude LOS of patients without DA-HAI. Device utilization ratio (DUR) equals the total number of device-days divided by the total number of bed days.

### Training

The INICC team trained infection control professionals (ICP) and hospital epidemiologists at hospitals. ICPs were also provided with tutorial movies, manuals and training tools that described in detail how to perform surveillance and upload surveillance data through the ISOS. In addition, ICPs assisted webinars, had continuous e-mail and telephone access to a support team at the INICC headquarters in Buenos Aires, Argentina.

### Definitions

The ISOS uses the CDC/NHSN surveillance definitions and criteria for all specific types of HAIs published in 2015 (6).

### Statistical analysis

INICC Surveillance Online System (ISOS) version 2.0 (Buenos Aires, Argentina), was used to calculate HAI rates, DUR, LOS and mortality. EpilInfo® version 6.04b (CDC, Atlanta, GA), SPSS 16.0 (SPSS Inc. an IBM company, Chicago, Illinois), and ISOS version 2.0 (Buenos Aires, Argentina), were used to conduct data analysis. Relative risk (RR) ratios, 95% confidence intervals (CIs) and P-values were determined for primary and secondary outcomes.

## RESULTS

During the study period from 1 April 2007 through 30 April 2015, 1,128 patients were hospitalized in the two participating medical surgical ICUs, amounting to 4,055 bed-days. The mean length of participation of the ICUs was (SD), 43.7 (35.6) months, range from 22 to 97 months.

The pooled means of the DA-HAI rates were 2.9 (n, 7) CLABs per 1,000 CL-days, during 2,422 CL-days with a DUR of 0.60 (95% CI, 0.58 – 0.61); 30.7 (n, 36) VAPs per 1,000 MV-days, during 1,173 MV-days, with a DUR of 0.29 (95% CI, 0.28 – 0.30); and 1.5 (n, 3) CAUTIs per 1,000 UC-days, during 2,021 UC-days, with a DUR of 0.50 (95% CI, 0.48 – 0.51).

Table 1 provides pooled means on crude ICU mortality and LOS in patients hospitalized during the surveillance period, with and without DA-HAI, and crude excess mortality and LOS of patients with CLABSI and VAP. The DA-HAI associated with the highest mortality and longest LOS was VAP. CAUTI mortality was not calculated due to the small sample size.

Table 2 provides data on bacterial resistance of pathogens isolated from patients with DA-HAI in ICUs. Resistance rates of *S. aureus* and coagulase negative staphylococcus to oxacillin and of *P. aeruginosa* to imipenem/meropenem were high.

Table 3 compares the results of this report from Costa Rica with the INICC international report for the period 2007-2012 and with the US CDC/NHSN report of 2013 (4, 5). The rate of VAP was higher in this study than in INICC and CDC/NHSN reports. The CLABSI rate was higher in this study than in CDC/NHSN, but it was similar to the INICC rates. Finally, the rate of CAUTI in this study was lower than INICC and similar to CDC/NHSN's rate. Although the DUR was higher for CL in this study compared to INICC and CDC/NHSN, UC DUR was lower than INICC and CDC/NHSN's.

Table 4 compares the antimicrobial resistance rates of this report from Costa Rica with the INICC international report for the period 2007-2012(5) and with the US CDC/NHSN report of 2009-2010 (3). Resistance of *S. aureus* to oxacillin and *E. coli* to imipenem or meropenem was higher in this study than in both of the afore-mentioned international reports.

## DISCUSSION

This is the first study that has analyzed DA-HAIs in Costa Rica. If compared with other similar studies conducted in Latin America, the DA-HAI rates found in this study are significantly higher. In a study conducted in Colombia, DA-HAI rates were higher than this study's: the rate of VAP was 32.3 per 1,000 MV-days, the CLABSI rate was 47.4 per 1,000 CL-days, and the CAUTI rate was 20.3 per 1,000 UC-days (27). By contrast, pooled crude mortality was higher in this study than in a study conducted in Colombia, whose findings showed that the crude unadjusted mortality attributable to DA-HAI was 16.9% among patients with VAP (relative risk [RR], 1.93; 95% confidence interval [CI], 1.24-3.00; P=.002); 18.5% among those with CLABSI (RR, 2.02; 95% CI, 1.42-2.87; P<.001); and 10.5% among those with CAUTI (RR, 1.58; 95% CI, 0.78-3.18; P=.19).(27) In Peru, Cuellar L. et al. found that the VAP rate was 31.3 per 1000 MV-days; the CLABSI rate was 7.7 cases per 1000 CL-days; and the rate for CAUTI was 5.1 cases per 1000 UC-days.(28) In a similar study conducted in ICUs in Brazil, VAP posed the greatest risk (20.9 per 1000 MV-days), followed by CAUTI (9.6 per 1000 UC-days) and CLABSI (9.1 per 1000 CL-days) (29).

From an international perspective, the results of this study show that most DA-HAI rates and DURs found in the ICU setting of Costa Rica were significantly higher than the rates reported by the U.S. CDC/NHSN, which would well represent the situation in high-income countries (4). On the other hand, the CLABSI rate in this study was higher than the international INICC Report (2007-2012) for 43 countries (5),

**TABLE 3:** Benchmarking of device-associated healthcare-acquired infection rates in this report against the report of the International Nosocomial Infection Control Consortium (2007-2012) and the report of the US Centers for Disease Control and Prevention's National Healthcare Safety Network data (2013)

Medical Surgical ICU	This Report Rate (95% CI)	INICC Report (2007-2012)(5) Rate (95% CI)	U.S. CDC-NHSN Report (2013)
CL, DUR	0.60 (0.58 – 0.61)	0.54 (0.54 – 0.54)	0.37
CLABSI rate (CLABSIs per 1000 CL-days)	2.9 (1.2 – 6.0)	4.9 (4.8 – 5.1)	0.8
MV, DUR	0.29 (0.28 – 0.30)	0.36 (0.36 – 0.36)	0.24
VAP rate (VAPs per 1000 MV-days)	30.7 (21.5 – 42.5)	16.5 (16.1 – 16.8)	1.1
UC, DUR	0.50 (0.48 – 0.51)	0.62 (0.62 – 0.62)	0.54
CAUTI rate (CAUTIs per 1000 UC-days)	1.5 (0.3 – 4.3)	5.3 (5.2 – 5.8)	1.3

ICU, intensive care unit; CLABSI, central line-associated bloodstream infection; VAP, ventilator-associated pneumonia; CAUTI, catheter-associated urinary tract infection; DUR, device utilization ratio; CI, Confidence Interval; CL, Central line; MV, mechanical ventilator; UC, urinary catheter; INICC, International Nosocomial Infection Control Consortium; CDC-NSHN, Centers for Disease Control and Prevention's National Healthcare Safety Network.

**Table 4:** Benchmarking of Antimicrobial Resistance Rates in this Report Against the Report of the International Nosocomial Infection Control Consortium (2007-2012) and the Report of the US National Healthcare Safety Network Data (2009-2010)

	This Report Resistance % (n/n)	INICC 2007-2012 Resistance %	CDC-NHSN 2009-2010 Resistance, %
<b>Pathogen, antimicrobial</b>	<b>VAP</b>	<b>VAP</b>	<b>VAP</b>
<i>S. aureus</i> Oxacillin	100% (1/1)	62%	48.4%
<i>P. aeruginosa</i> Ciprofloxacin	20% (1/5)	41.9%	32.7%
Piperacillin or piperacillin-tazobactam	40% (2/5)	35.8%	19.1%
<i>K. pneumoniae</i> Imipenem or meropenem	0% (0/4)	17.2%	11.2%
<i>A. baumannii</i> Imipenem or meropenem	0% (0/1)	77.1%	61.2%
<i>E. coli</i> Imipenem or meropenem	50% (1/2)	7.5%	3.5%

VAP, ventilator-associated pneumonia; CDC-NSHN, Centers for Disease Control and Prevention's National Healthcare Safety Network.

representing middle and low-income countries, as was the CL DUR. By contrast, despite the VAP rate in this study being substantially higher than INICC's, the DUR for MV in this study was lower, pointing to potential risk factors other than DURs influencing DA-HAI rates. Finally, the CAUTI rate in this study was lower than INICC's and similar to CDC/NHSN's, with a lower UC DUR than both international reports; however, these results should be considered cautiously due to a small sample size (4, 5).

The antimicrobial resistance rates found in this ICUs were higher than CDC/NHSN (4) and INICC reports'(5) rates for *S. aureus* as resistant to oxacillin, for *P. aeruginosa* as resistant to piperacillin-tazobactam, and for *E. coli* as resistant to imipenem or meropenem. On the other hand, the resistance rates for *P. aeruginosa* to ciprofloxacin, *K. pneumoniae* as resistant to imipenem or meropenem, and *A. baumannii* as resistant to imipenem or meropenem were lower in this study than U.S. CDC/NHSN report,(3) and also lower than the INICC reported resistance rates (5).

There are many reasons that can explain these higher DA-HAI rates compared both to US CDC/NHSN and INICC reports (30, 31). As in other countries, adherence to infection control bundles in Costa Rica is variable, nurse-to-patient staffing ratios are usually low (and closely associated with higher DA-HAI rates in ICUs), as well as hospital over-crowding, and an insufficient number of experienced nurses or trained healthcare workers (32).

In order to reduce the risk of infection of patients hospitalized in ICUs, surveillance targeting DA-HAI is fundamental to effectively addressing the burden of DA-HAIs. Surveillance should be complemented with implementation of other practices aimed at DA-HAI control and prevention. In this sense, participation in INICC has played a critical role, not only in increasing the awareness of the risks posed by DA-HAIs in the ICU, but also providing an exemplary basis for the implementation of infection control practices through the use of an online process surveillance tool.

The INICC program is focused on surveillance of DA-HAIs in the ICUs, step down units and general wards, and surveillance of SSIs hospital wide. This particular study was focused on ICUs, because they are the healthcare settings that represent the highest HAI rates, due to patients' critical condition and exposure to invasive devices (32). Through the last 12 years, INICC has undertaken a global effort in America, Asia, Africa, Middle East, and Europe to prevent and control DA-HAIs, and has demonstrated success by increasing HH compliance, improving compliance with infection control bundles and interventions as described in several INICC publications, and consequently facilitating reduction of the rates of DA-HAI and mortality (15, 16, 33-35).

To compare a hospital's DA-HAI rates with the rates identified in this report, it is required that the hospital team concerned collect their data by applying the methods and methodology described for U.S. CDC/NHSN and INICC, and then calculate infection rates and DU ratios for the DA-HAI Module.

The particular and primary application of these data is to serve as a guide for the implementation of prevention strategies and other quality improvement efforts in Costa Rica for the reduction of DA-HAI rates to the minimum possible level.

### Study limitations

The findings in this report did not consider the difference in time periods for the different data sources in the comparisons made with INICC and U.S. CDC/NHSN.

### CONCLUSIONS

In conclusion, the data presented in this report fortify the fact that DA-HAIs in Costa Rica are a challenge for patient safety. It is INICC's main goal to enhance infection control practices, by facilitating elemental, feasible and inexpensive tools and resources to tackle this problem effectively and systematically, leading to greater and stricter adherence to infection control programs and guidelines, and subsequently to the reduction in DA-HAI in the hospitals participating in INICC, as well as at any other healthcare facility worldwide.

### REFERENCES

1. Laupland KB, Zygun DA, Doig CJ, Bagshaw SM, Svenson LW, Fick GH. One-year mortality of bloodstream infection-associated sepsis and septic shock among patients presenting to a regional critical care system. *Intensive Care Med* 2005;31:213-9.
2. Hughes JM. Study on the efficacy of nosocomial infection control (SENIC Project): results and implications for the future. *Chemotherapy* 1988;34:553-61.
3. Sievert DM, Ricks P, Edwards JR, et al. Antimicrobial-resistant pathogens associated with healthcare-associated infections: summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2009-2010. *Infect Control Hosp Epidemiol* 2013;34:1-10.
4. Dudeck MA, Edwards JR, Allen-Bridson K, et al. National Healthcare Safety Network report, data summary for 2013, Device-associated Module. *Am J Infect Control* 2015;43:206-21.
5. Rosenthal VD, Maki DG, Mehta Y, et al. International Nosocomial Infection Control Consortium (INICC) report, data summary of 43 countries for 2007-2012. Device-associated module. *Am J Infect Control* 2014;42:942-56.
6. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. 2015. (Accessed at <http://www.cdc.gov/nhsn/>.)
7. Rosenthal VD, Pawar M, Leblebicioglu H, et al. Impact of the International Nosocomial Infection Control Consortium (INICC) multidimensional hand hygiene approach over 13 years in 51 cities of 19 limited-resource countries from Latin America, Asia, the Middle East, and Europe. *Infect Control Hosp Epidemiol* 2013;34:415-23.
8. Rosenthal VD, Richtmann R, Singh S, et al. Surgical site infections, International Nosocomial Infection Control Consortium (INICC) report, data summary of 30 countries, 2005-2010. *Infect Control Hosp Epidemiol* 2013;34:597-604.
9. Rosenthal VD, Maki DG, Graves N. The International Nosocomial Infection Control Consortium (INICC): goals and objectives, description of surveillance methods, and operational activities. *Am J Infect Control* 2008;36:e1-12.
10. Rosenthal VD, Guzman S, Crnich C. Impact of an infection control program on rates of ventilator-associated pneumonia in intensive care units in 2 Argentinean hospitals. *Am J Infect Control* 2006;34:58-63.

11. Tao L, Hu B, Rosenthal VD, Zhang Y, Gao X, He L. Impact of a multidimensional approach on ventilator-associated pneumonia rates in a hospital of Shanghai: findings of the International Nosocomial Infection Control Consortium. *J Crit Care*;27:440-6.
12. Guanche-Garcell H, Morales-Perez C, Rosenthal VD. Effectiveness of a multidimensional approach for the prevention of ventilator-associated pneumonia in an adult intensive care unit in Cuba: findings of the International Nosocomial Infection Control Consortium (INICC). *J Infect Public Health* 2013;6:98-107.
13. Leblebicioglu H, Yalcin AN, Rosenthal VD, et al. Effectiveness of a multidimensional approach for prevention of ventilator-associated pneumonia in 11 adult intensive care units from 10 cities of Turkey: findings of the International Nosocomial Infection Control Consortium (INICC). *Infection* 2013;41:447-56.
14. Mehta Y, Jaggi N, Rosenthal VD, et al. Effectiveness of a multidimensional approach for prevention of ventilator-associated pneumonia in 21 adult intensive-care units from 10 cities in India: findings of the International Nosocomial Infection Control Consortium (INICC). *Epidemiol Infect* 2013;141:2483-91.
15. Rosenthal VD, Alvarez-Moreno C, Villamil-Gomez W, et al. Effectiveness of a multidimensional approach to reduce ventilator-associated pneumonia in pediatric intensive care units of 5 developing countries: International Nosocomial Infection Control Consortium findings. *Am J Infect Control* 2012;40:497-501.
16. Rosenthal VD, Rodriguez-Calderon ME, Rodriguez-Ferrer M, et al. Findings of the International Nosocomial Infection Control Consortium (INICC), Part II: Impact of a multidimensional strategy to reduce ventilator-associated pneumonia in neonatal intensive care units in 10 developing countries. *Infect Control Hosp Epidemiol* 2012;33:704-10.
17. Rosenthal VD, Rodrigues C, Alvarez-Moreno C, et al. Effectiveness of a multidimensional approach for prevention of ventilator-associated pneumonia in adult intensive care units from 14 developing countries of four continents: findings of the International Nosocomial Infection Control Consortium. *Crit Care Med* 2012;40:3121-8.
18. Rosenthal VD, Guzman S, Pezzotto SM, Crnich CJ. Effect of an infection control program using education and performance feedback on rates of intravascular device-associated bloodstream infections in intensive care units in Argentina. *Am J Infect Control* 2003;31:405-9.
19. Higuera F, Rosenthal VD, Duarte P, Ruiz J, Franco G, Safdar N. The effect of process control on the incidence of central venous catheter-associated bloodstream infections and mortality in intensive care units in Mexico. *Crit Care Med* 2005;33:2022-7.
20. Jaggi N, Rodrigues C, Rosenthal VD, et al. Impact of an international nosocomial infection control consortium multidimensional approach on central line-associated bloodstream infection rates in adult intensive care units in eight cities in India. *Int J Infect Dis* 2013;17:e1218-24.
21. Leblebicioglu H, Ozturk R, Rosenthal VD, et al. Impact of a multidimensional infection control approach on central line-associated bloodstream infections rates in adult intensive care units of 8 cities of Turkey: findings of the International Nosocomial Infection Control Consortium (INICC). *Ann Clin Microbiol Antimicrob* 2013;12:10.
22. Rosenthal VD, Guzman S, Safdar N. Effect of education and performance feedback on rates of catheter-associated urinary tract infection in intensive care units in Argentina. *Infect Control Hosp Epidemiol* 2004;25:47-50.
23. Leblebicioglu H, Ersoz G, Rosenthal VD, et al. Impact of a multidimensional infection control approach on catheter-associated urinary tract infection rates in adult intensive care units in 10 cities of Turkey: International Nosocomial Infection Control Consortium findings (INICC). *Am J Infect Control* 2013;41:885-91.
24. Kanj SS, Zahreddine N, Rosenthal VD, Alamuddin L, Kanafani Z, Molaeb B. Impact of a multidimensional infection control approach on catheter-associated urinary tract infection rates in an adult intensive care unit in Lebanon: International Nosocomial Infection Control Consortium (INICC) findings. *Int J Infect Dis* 2013;17:e686-90.
25. Navoa-Ng JA, Berba R, Rosenthal VD, et al. Impact of an International Nosocomial Infection Control Consortium multidimensional approach on catheter-associated urinary tract infections in adult intensive care units in the Philippines: International Nosocomial Infection Control Consortium (INICC) findings. *J Infect Public Health* 2013;6:389-99.
26. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. 2015. (Accessed at <http://www.cdc.gov/nhsn/>)
27. Moreno CA, Rosenthal VD, Olarte N, et al. Device-associated infection rate and mortality in intensive care units of 9 Colombian hospitals: findings of the International Nosocomial Infection Control Consortium. *Infect Control Hosp Epidemiol* 2006;27:349-56.
28. Cuellar LE, Fernandez-Maldonado E, Rosenthal VD, et al. Device-associated infection rates and mortality in intensive care units of Peruvian hospitals: findings of the International Nosocomial Infection Control Consortium. *Rev Panam Salud Publica* 2008;24:16-24.
29. Salomao R, Rosenthal VD, Grimberg G, et al. Device-associated infection rates in intensive care units of Brazilian hospitals: findings of the International Nosocomial Infection Control Consortium. *Rev Panam Salud Publica* 2008;24:195-202.
30. Rosenthal VD, Lynch P, Jarvis WR, et al. Socioeconomic impact on device-associated infections in limited-resource neonatal intensive care units: findings of the INICC. *Infection* 2011;39:439-50.
31. Rosenthal VD, Jarvis WR, Jamulitrat S, et al. Socioeconomic impact on device-associated infections in pediatric intensive care units of 16 limited-resource countries: International Nosocomial Infection Control Consortium findings\*. *Pediatr Crit Care Med* 2012;13:399-406.
32. Rosenthal VD, Maki DG, Salomao R, et al. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. *Ann Intern Med* 2006;145:582-91.
33. Rosenthal VD, Bijie H, Maki DG, et al. International Nosocomial Infection Control Consortium (INICC) report, data summary of 36 countries, for 2004-2009. *Am J Infect Control* 2012;40:396-407.
34. Rosenthal VD, Maki DG, Rodrigues C, et al. Impact of International Nosocomial Infection Control Consortium (INICC) strategy on central line-associated bloodstream infection rates in the intensive care units of 15 developing countries. *Infect Control Hosp Epidemiol* 2010;31:1264-72.
35. Rosenthal VD, Ramachandran B, Villamil-Gomez W, et al. Impact of a multidimensional infection control strategy on central line-associated bloodstream infection rates in pediatric intensive care units of five developing countries: findings of the International Nosocomial Infection Control Consortium (INICC). *Infection* 2012;40:415-23. 🌸

## CASE REPORT

# Wound infection due to *Escherichia vulneris*: A rare human pathogen

Dr. Sonal Gupta, MBBS, MD<sup>1</sup>, Dr. Archana Thakur<sup>2</sup>, Dr. Bibhawati Mishra<sup>3</sup>

<sup>1</sup>Microbiology, Senior resident, G B Pant hospital, New Delhi

<sup>2</sup>Director Professor, Department of Microbiology, G B Pant hospital, New Delhi

<sup>3</sup>Director Professor & HOD, G B Pant hospital, New Delhi

Corresponding author: **Dr. Sonal Gupta**

AA-71, Shalimar bagh, Delhi

P: 9999799850

E: drsonal2007@gmail.com

## ABSTRACT

*Escherichia vulneris* has been reported to be an environmental organism that can colonize and infect wounds in humans and animals. To date, very few human infections with *E. vulneris* have been reported, and pathogenicity has not always been evident. Clinical significance of *E. vulneris* has not been established yet, however, it has been reported to be the sole pathogen in some cases of osteomyelitis, urosepsis, and bacteremia. Here we report on a rare case of wound infection caused by this pathogen.

## INTRODUCTION

*Escherichia vulneris* is a relatively recently identified environmental organism that can colonize humans and animals (2). *Escherichia vulneris* was formerly known as CDC enteric group 1 and was recognized as a new species of the family *Enterobacteriaceae* only in 1982 (3). It is a gram-negative, oxidase-negative, indole-negative, fermentative, motile rod with the characteristics of the family *Enterobacteriaceae*. It has been isolated from animals, the environment, potable water, and humans (3, 4). In humans, *E. vulneris* can colonize the respiratory tract, female genital tract, urinary tract, and gastrointestinal tract; however, its propensity for wound colonization led to it being named "vulneris" (Latin for "wound") (3).

To date, only few human infections with *E. vulneris* have been reported (1). Here we report on a rare case of wound infection with *E. vulneris*.

## CASE REPORT

A 30-year-old male presented with a painful wound measuring 10x4 cm on the dorsal aspect of his right foot. Patient gave history of trauma from a heavy wooden block resulting in a laceration 10 days prior. Patient gave history that the wound was initially cleaned with betadine, debrided and on alternate days dressing was done for seven days. The wound did not heal, but rather started deteriorating, leading the patient to seek medical attention.

On examination, the wound showed signs of inflammation and infection which included localized erythema, cellulites, discoloration of tissues both within and at the wound margins, with purulent discharge from the wound. The wound had developed strips of granulation tissue in the base only as opposed to a uniform spread of granulation tissue across the whole of the wound bed in healthy wound. There was no history or evidence of any systemic involvement.

## METHODS

Three wound swabs were collected from the margins of the wound. One swab was transported in thioglycolate broth for anaerobic culture. From second swab primary cultures were done on blood agar, chocolate agar, MacConkey agar, Sabouraud agar and glucose broth was also inoculated. Cultures were incubated aerobically and anaerobically at 37°C overnight. Two Sabouraud agar plates were incubated at 25°C and 37°C. Microscopic examination of Gram-stained smears of the purulent secretions from the third swab, revealed many white cells and gram-negative rods.

## RESULTS

Following overnight incubation aerobically, pure colonies were obtained on blood agar and MacConkey agar plates. No growth was seen on plates incubated anaerobically. Colonies on blood agar were circular, 1-3 mm in diameter, low convex, smooth, translucent and yellow-pigmented. On MacConkey agar colonies were pink indicating that the organism ferments lactose. The isolated microorganism was motile. It was identified as *Escherichia vulneris* by use of the Vitek® 2 system (BioMérieux). Specifically, the microorganism fermented d-glucose to acid and gas, d-mannitol, l-arabinose, maltose, trehalose, cellobiose, d-mannose; negative for lactose, sucrose, adonitol, d-sorbitol arabinose, d-arabitol. It gave negative reactions for indole, oxidase test, esculin hydrolysis, arginine dihydrolase, H<sub>2</sub>S, and urease production, and for lysine and ornithine decarboxylase and citrate; its Voges-Proskauer reaction was also negative. Methyl red test was positive, and nitrate was reduced to nitrite.

Antimicrobial susceptibility testing of the microorganism was determined by the VITEK® 2 system according to the CLSI MIC interpretative standards (1). The isolate was found susceptible to amoxicillin, ampicillin-sulbactam,

piperacillin-tazobactam, cefazolin, ceftriaxone, cefepime, ceftazidime, aztreonam, imipenem, meropenem, ertapenem, ciprofloxacin, moxifloxacin, tobramycin, amikacin, gentamicin, trimethoprim-sulfamethoxazole, and resistant to cefuroxime and nitrofurantoin. Based on the susceptibility results, the patient was given augmentin and patient improved after 72 hours.

## DISCUSSION

In 1982, Brenner et al. (3) classified *Escherichia vulneris* as a new species in the family Enterobacteriaceae on the basis of DNA relatedness studies and biochemical reactions. *E. vulneris* has a propensity for causing human wound infections, particularly of the arms and legs (5), which is consistent with our case that developed a wound on his foot. Most isolates of *E. vulneris* have been recovered from wounds. However, pathogenicity has not always been evident (5).

The patient had injury from a wooden block on the road and *E. vulneris* has been reported to be an environmental organism that can colonize and infect wounds in humans and animals (2). Clinical significance of *E. vulneris* has not been established yet, however *E. vulneris* has been reported to be the sole pathogen in some cases of osteomyelitis, urosepsis, and bacteremia (6,7,8). Previous isolations from wound have been reported but *E. vulneris* was not the sole isolate (6). In wounds with *E. vulneris* infection, co-infection with other bacteria has been observed. (5),(9),(10). However, in our case, the organism grew in primary cultures as a pure growth. The organism showed biochemical reactions to place it in genus *Escherichia* and species *vulneris* (5). No other aerobes or anaerobes or fungi were isolated from wound suggesting that it was a sole pathogen, further attested by the fact that patient improved after appropriate antibiotic therapy.

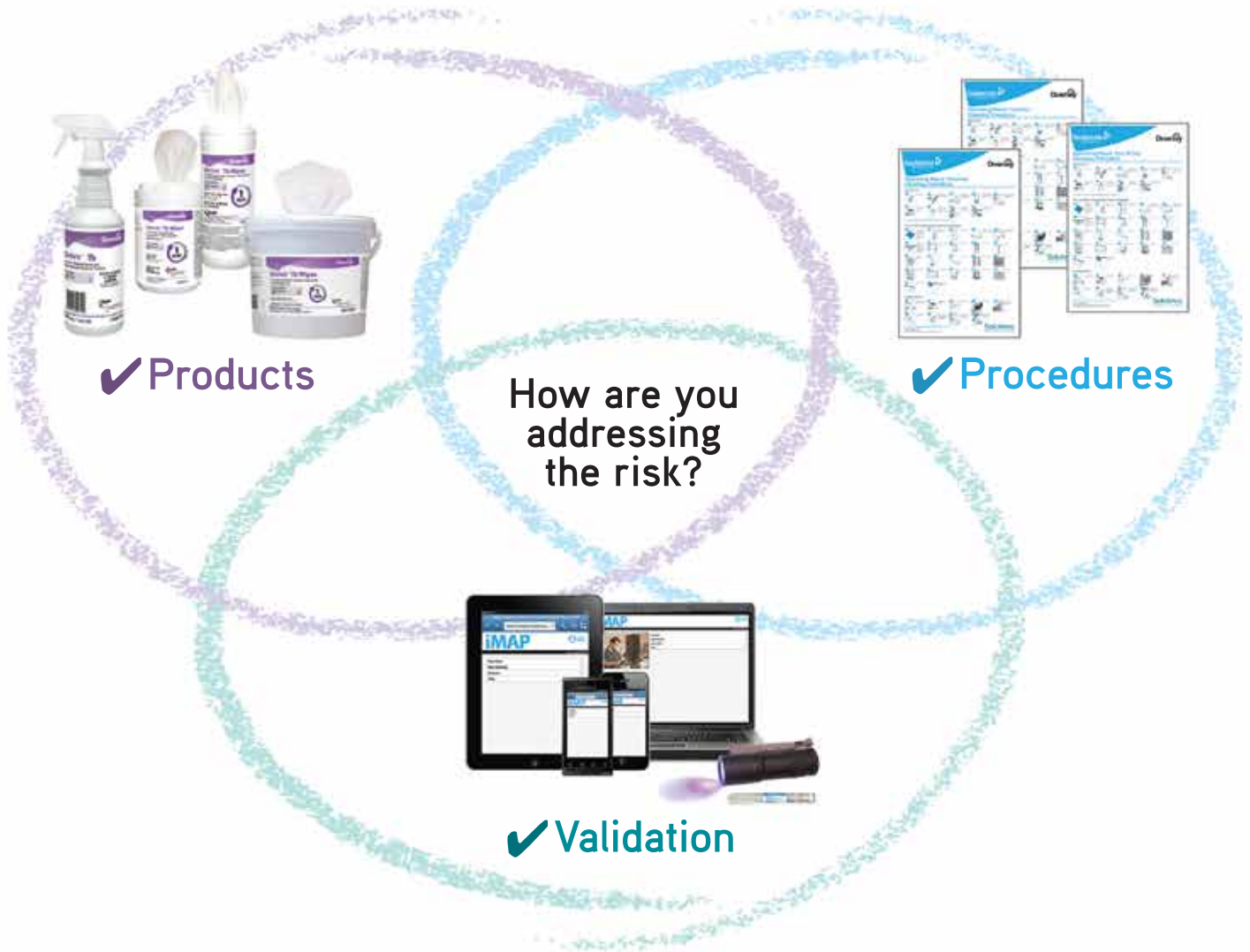
In this case, susceptibility testing was performed by disk diffusion methods using CLSI zone diameter interpretive standards for Enterobacteriaceae because *E. vulneris* is a recognized species of this family (5) and by VITEK® 2 system; however, *E. vulneris* is not noted specifically in the CLSI performance standards for antimicrobial susceptibility testing. A review of 23 *E. vulneris* strains found that they were not identical to *Escherichia coli*, being slightly more susceptible to aminoglycosides and slightly less susceptible to nitrofurantoin (2, 11). This is consistent with our case as it was also susceptible to most of the antibiotics except cefuroxime and nitrofurantoin.

Though *E. vulneris* can cause infections in wounds particularly in upper and lower limbs, it responds to most of the routinely used antibiotics.

*Escherichia vulneris* isolation has been reported from reusable sharps container by Runner J C (12). Wild birds have also been reported to transmit multidrug resistant *E. coli* and *E. vulneris* to water streams and other environmental sources through their faecal residues, and to remote regions by migration (13). Within hospital environment patients colonized or infected with *E. vulneris* should be managed on Universal Precautions/ Routine Practices to reduce the risk of transmission.

## REFERENCES

1. Clinical and Laboratory Standards Institute. 2008. Performance standards for antimicrobial susceptibility testing: sixteenth informational supplement. Clinical and Laboratory Standards Institute, Wayne, PA.
2. Senanayake SN, Jadeer A, Talauikar GS, Roy J. First Reported case of Dialysis- related peritonitis due to *Escherichia vulneris*. *J Clin Microbiol* 2006;44(11).
3. Brenner DJ, McWhorter AC, Knutsom JK, Steigerwalt AG. *Escherichia vulneris*: A new species of Enterobacteriaceae associated with human wounds. *J Clin Microbiol* 1982;15:1133-40.
4. Le Querler L, Donnino PY, Poisson M, Rouzet-Gras S, Avril JL. Isolation of *Escherichia vulneris* in drinking water. *Ann. Biol. Clin.* 1997;55:33-35.
5. Winn W, Allen S, Janda W, Koneman E, Procop G, Schreckenberger, Woods G. Koneman's Color Atlas and textbook of Diagnostic Microbiology, Ch. 6, Enterobacteriaceae. 6th edition, pp. 211-302. 2006, Lippincott Williams & Wilkins.
6. Pien FD, Shrum S, Swenson JM, Hill BC, Thornsberry C, Farmer JJ III. Colonization of human wounds by *Escherichia vulneris* and *Escherichia hermannii*. *J Clin Microbiol.* 1985;22:283-5.
7. Levine WN, Goldberg MJ. *Escherichia vulneris* osteomyelitis of the tibia caused by a wooden foreign body. *Orthop Rev.* 1994;23:262-5.
8. Awsare SV, Lillo M. A case report of *Escherichia vulneris* urosepsis. *Rev Infect Dis* 1991;13:1247-8.
9. Spaulding AC, Rothman AL. *Escherichia vulneris* as a cause of intravenous catheter-related bacteremia. *Clin Infect Dis* 1996;22:728-9.
10. Horii T, Suzuki Y, Kimura T, Kanno T, Maekawa M. Intravenous catheter-related septic shock caused by *Staphylococcus sciuri* and *Escherichia vulneris*. *Scand J Infect Dis* 2001;33:930.
11. Stock, I., B. Wiedemann. Natural antibiotic susceptibility of *Escherichia coli*, *Shigella*, *E. vulneris* and *E. hermannii* strains. *Diagn Microbiol Infect Dis* 1999;33:187-199.
12. Runner J C. Bacterial and viral contamination of reusable sharps containers in a community hospital setting. *Am j Infect Control.* 2007;35:527-30.
13. Shobrak M Y, Abo-Amer A E. Role of wild birds as carriers of multi- drug resistant *Escherichia coli* and *Escherichia vulneris*, *Braz.j.Microbiol.* 2014, vol45. 🌸



## Dramatically reduce HAIs with a strategic approach to HTS disinfection

Daily use of disinfectant/cleaner wipes on high-touch surfaces, when combined with high levels of cleaner compliance, has been proven to reduce the rate of key hospital-acquired infections.\* Oxivir® disinfectant/cleaner wipes are the effective, yet gentle bactericidal/virucidal solution. Combined with industry-leading training and validation tools, these products deliver a potent first line of defense in the battle against HAIs.

**✓ Products** like Oxivir® Tb help eliminate HAIs within every cleaning and disinfection workflow. These disinfectant/cleaners are enabled with AHP® – the responsible choice! They're effective, yet gentle on people and assets.

**✓ Procedures** that standardize processes and help ensure consistent performance. Training programs and best-practice protocols enhance cleaning and disinfection efficiency and effectiveness.

**✓ Validation** system that provides actionable intelligence that can be used to provide feedback to employees, improve the cleaning and disinfection of high touch surfaces and empower employees to drive continuous improvement.

For more information, visit [SDFHC.com/contact-us](http://SDFHC.com/contact-us) or call 800-558-2332.

\*American Journal of Infection Control, February 1, 2015, Volume 43, Issue 2, Pages 141-146, Michelle J. Alfa, PhD, Evelyn Lo, MD, Nancy Olson, BSc, Michelle MacRae, Louise Buelow-Smith, RN  
AHP and Design® are registered trademarks of Virox Technologies, Inc. used under license.



**XENEX**  
GERM-ZAPPING ROBOTS™

# I made a change that makes our hospital safer for patients and employees.

**Kristin Vondrak, Vice President and Chief  
Quality Officer, Baptist Health System,  
Jacksonville, FL**



## Join Kristin as a Face of Change.

Baptist Health has continued to focus on enhancing quality and patient safety by integrating Xenex Germ-Zapping Robots™ into their overall infection prevention strategy.

Xenex Robots are the only UV disinfection technology shown in multiple peer reviewed published studies to reduce hospital acquired infection (HAIs) rates.

## Peer reviewed published outcomes:

- ✓ 100% reduction in total joint SSIs.<sup>1</sup>
- ✓ 70% reduction in ICU *C. diff* infection rates.<sup>2</sup>
- ✓ 53% reduction in *C. diff* infection rates.<sup>3</sup>
- ✓ 57% reduction in MRSA infection rates.<sup>4</sup>

1. Fornwalt L, et al., Trinity Medical Center, in AJIC 2015. 2. Nagaraja A, et al., Westchester Medical Center in AJIC 2015. 3. Levin J, et al., Cooley Dickinson in AJIC 2013, 41:746-748. 4. Simmons S, et al., Cone Health System in JIP 2013.



Become a Face of Change Today.  
[xenex.com/kristin](http://xenex.com/kristin) | 888 764 2964 | @XenexDisinfect





# Fast + Effective



## A Fast and Effective Equipment Washer...

**Medco Equipment, Inc.**'s multipurpose portable equipment washer provides dramatic bacteria reduction. Independent lab tests have documented an impressive 99.9% reduction in bacteria *after one wash!* This machine washes and sanitizes two wheelchairs in five minutes. It also cleans commode chairs, shower chairs, walkers, carts, window screens etc. **2,000 customers worldwide are now sanitizing more than 3.4 million wheelchairs yearly!**

Free 30 day trial and delivery. Rent, lease-purchase or purchase. It's a portable dishwasher for wheelchairs and equipment! All stainless steel. CE,UL and CUL listed, 5 year wall to wall warranty. Seven day delivery.



For more information call (800) 717-3626 or visit [www.medcoequipment.com](http://www.medcoequipment.com)

# FAST, EFFECTIVE, EASY

# ASEPTIX<sup>2</sup>

World's fastest mobile UVC disinfection system

- Disinfects rooms in 5 minutes
- Push button or wireless activation
- Automated location and disinfection tracking
- Ideal for patient rooms and ORs
- Payment plans available



Dual unit operation guarantees effective disinfection in 5 minutes



Units fasten together  
for easy movement  
room-to-room



# Our hand hygiene COMPLIANCE IS 95%\*

\* Only when someone is watching.



Direct observation of hand hygiene compliance is enormously flawed. And unreliable data can put patients at risk.

DebMed's non-intrusive approach to electronic hand hygiene compliance monitoring produces results identical to 24-hour video monitoring. Get the accurate data you need to increase compliance and patient safety.

See the whole picture. *Visit [DebMed.com](http://DebMed.com).*

**HealthPRO**  
Choice. Support. Results.  
Now on Contract.

**debmed**  
www.debmed.com

**SGP**  
SILVER GROUP PURCHASING  
CONTRACT HOLDER

# INNOVA<sup>®</sup> E-Series Pass-Through

## The New Standard in Endoscope Reprocessing

**Physically Separate  
Clean and Soiled Areas**



**Optimized  
One-Way Workflow**



## Minimize Endoscope Recontamination Risks

SciCan recognizes the importance of a one-way workflow to reduce recontamination risks.

Designed with patient safety and CSA standards in mind, INNOVA<sup>®</sup> AERs combine an innovative pass-through design and a patented Channel Monitoring System (CMS), which enables you to check all channels of an endoscope for any restrictions. With a reprocessing capacity of up to four endoscopes and a reduced consumption of chemicals, these units are recognized for their unparalleled performance and productivity.

**Learn more at [www.scican.com/innova](http://www.scican.com/innova)**

## INSIDE:

- 
- 45 President's Message
- 
- 46 Message de la présidente
- 
- 47 From the Executive Desk
- 
- 49 2016 National Education Conference
- 
- 59 Board Elections
- 
- 65 Honorary Member
- 
- 66 CIC® Graduates
- 



If you think doing more for patient safety is unaffordable, how does

**FREE**\* sound?

Practical  
Affordable  
Safe & Simple

Findings show that up to **43%** of mattresses in Canadian hospitals are damaged!\*\*

damage gone  
**too far ...**

**BETTER**  
patient safety with  
no new money...  
**Bank on it!**

It's only a thin sheet of cotton that lies between your patient and exposure to a potential reservoir of harmful pathogens, inside the foam core of a compromised mattress or treatment pad. CleanPatch® is an effective repair alternative to costly mattress replacement.

Mattress Integrity Assessment and repair service, delivers convenience, peace of mind, and an attractive return on investment.



\*Investing in a Mattress Integrity Assessment not only increases patient safety but it pays for itself through cost savings.  
\*\*Mattress damage rate findings from 2014-2015 manufacturer sponsored Canadian field trials.



Suzanne Rhodenizer Rose, RN, BScN, MHS, CIC

President, IPAC Canada

## The what, how and why

It's spring... I think!? With the sprouting of daffodils comes a time of some much-needed inspiration! Colleague and friend, Greg Bruce, shared an inspirational speaker's video with me and I have to say, I was inspired! It was entitled *Start with Why: How great leaders inspire action* with Simon Sinek.

Sinek describe what he calls the Golden Circle; a series of concentric circles with the outer ring signifying *the what*, the middle ring as *the how* and the inner circle representing *the why*. He went to explain that there are leaders, those in positions of authority, and then there are those who lead and who inspire others. The key point is that those leaders who can inspire start thinking, acting, and communicating from the inside out or from the inner circle of the why. Have I confused you? In other words, people (insert patients/healthcare workers/teenagers!) don't buy *what* you do but *why* you do.

I have seen this philosophy successfully in action a number of times in the field of infection prevention and control; not often, but often enough to know it can be a key to success. I think the general collective relies on thinking, acting and communicating from that outer ring; from *the what*. As Sinek summed up his talk, he cited Martin Luther King's famous words, "I have a dream!" What Martin Luther King did not say was "I have a plan!" Let's just try out this approach and see how we all do. Let's see if we can get better, safer, patient outcomes because we thought, acted, and communicated *the why*.

"With the sprouting of daffodils comes a time of some much-needed inspiration! Colleague and friend, Greg Bruce, shared an inspirational speaker's video with me and I have to say, I was inspired!"

In my own professional life, I am closing out one chapter, leaving the civil service, and going back to my roots in the clinical setting with the Nova Scotia Health Authority. The last day of work was a tough day indeed; however, it was affirming to have well-respected colleagues share their thoughts and what impacts I had on them professionally. I was told by one that he saw me as a "true believer of what healthcare should be" and that he had no doubt that that vision will transfer nicely with me as I embark on my new role. My hope and expectation of myself is that I will, in fact, show to my new team and colleagues *the why* of what we are doing and that the patients in our care reap the results.

Looking forward to seeing everyone at the 2016 IPAC Canada Education Conference in Niagara Falls! This year's theme is *Wisdom Begins With Wonder* – perhaps the IPAC Conference Scientific Planning Committee was unknowingly channeling MLK?

See you in Niagara Falls! 🍁

**Emerald**  
HEALTH INFORMATION SYSTEMS

**ICS Infection Control and Surveillance**

- Improve Patient Outcomes
- Improve Hospital Performance
- Reduce Costs

Secure real time solutions for IC Professionals,  
Antibiotic Stewardship and Healthcare Leaders.

info@emeraldhis.com ..... emeraldhis.com

CONTACT 1.613.599.8178 EXT 211 FOR A DEMONSTRATION



Suzanne Rhodenizer Rose, IA, B.Sc.Inf., MHS, PCI

Présidente, PCI Canada

## Le quoi, comment et pourquoi

C'est le printemps... au moins, je pense que oui! Le bourgeonnement des jonquilles arrive à un moment où nous pouvons nous trouver en deuil d'inspiration. Mon collègue et ami, Greg Bruce, a partagé avec moi la vidéo d'un conférencier motivateur et je dois l'admettre, j'ai été inspiré! La vidéo est produite par Simon Sinek et s'intitule « *Start with Why: How great leaders inspire action* ».

Dans cette vidéo, M. Sinek décrit ce qu'il appelle le Cercle d'or : un ensemble de trois cercles concentriques dont le *pourquoi* est au centre. Le cercle suivant représente le *comment*, et le dernier cercle, le *quoi*. M. Sinek enchaîne en précisant qu'il y a des dirigeants qui sont en position d'autorité, et il y a des dirigeants qui guident et qui inspirent les autres. Le point essentiel est que les dirigeants inspirés pensent, agissent et communiquent de l'intérieur vers l'extérieur, à partir du *pourquoi*. Autrement dit, les gens (patients/travailleurs de la santé/et même les adolescents!) ne sont pas convaincus par ce que vous faites; ils sont convaincus par la raison qui vous pousse à le faire (le *pourquoi*).

J'ai observé à plusieurs reprises la réussite de la mise en pratique de cette philosophie dans le domaine de la prévention et du contrôle des infections. Pas souvent, mais assez souvent pour savoir qu'elle peut être la clé du succès. Je crois qu'en général notre manière de penser, d'agir et de communiquer se fait à partir de l'extérieur, du *quoi*. M. Sinek résuma son

exposé avec les célèbres paroles de Dr Martin Luther King : « *I have a dream!* » Dr King n'a pas dit, « *I have a plan!* » Essayons d'adopter cette démarche et d'observer comment nous nous en tirons. Voyons si nous pouvons obtenir de meilleurs résultats plus sécuritaires pour les patients parce que nous avons pensé, agi, et communiqué le *pourquoi*.

Dans ma vie professionnelle, je ferme tout un chapitre en quittant la fonction publique pour le retour aux sources en milieu clinique avec la Nova Scotia Health Authority. Mon dernier jour de travail a été très difficile. Cependant, c'était encourageant d'entendre mes collègues que je respecte énormément me faire part de leurs réflexions professionnelles et de l'effet positif que j'ai eu sur eux. L'un d'eux m'a dit que je représentais pour lui une vraie partisane de ce que les soins de santé devraient être et qu'il était sûr que j'allais bien transférer cette vision dans mon nouveau rôle. J'ai bon espoir que je démontrerai à ma nouvelle équipe et mes collègues le *pourquoi* de ce que nous faisons et que nos patients en retirent les bénéfices.

Au plaisir de vous voir tous au congrès éducatif 2016 de PCI Canada à Niagara Falls! Le thème de cette année sera « *Wisdom Begins With Wonder* ». Le comité de planification scientifique du congrès de PCI Canada a-t-il inconsciemment canalisé le Dr King?

On se retrouvera à Niagara Falls! ❁

« Le bourgeonnement des jonquilles arrive à un moment où nous pouvons nous trouver en deuil d'inspiration. Mon collègue et ami, Greg Bruce, a partagé avec moi la vidéo d'un conférencier motivateur et je dois l'admettre, j'ai été inspiré! »







Gerry Hansen, BA

Executive Director, IPAC Canada

## Sharing a Common Interest

It was an honour to be able to attend the 2016 conference of the International Federation of Infection Control (IFIC) in Vienna in March 2016. With my colleagues from the IPAC Canada Board of Directors, Suzanne Rhodenizer Rose and Ramona Rodrigues, I spent a most enjoyable four days of education, international networking, and memorable social events.

My perspective at the conference was likely a little different than my practitioner colleagues. I looked at the administrative networking opportunities, interaction with industry, and the education sessions that would help me better understand the profession, the issues, and the practices of other professional organizations. What struck me, and this has been noted by others who have attended this international conference, is the diversity of attendees and their backgrounds, yet the similarity of the concerns and experiences.

In North America, we are fortunate to be able to work towards national recognition of the profession and facilitation of various initiatives with the support of a large membership base and collaboration with stakeholder organizations. Not so our colleagues in countries with significantly fewer resources. They are often working in silos, with little or no funding and even fewer opportunities for networking and education. It is ingrained in our Canadian

nature to provide whatever support we can to those asking for assistance. We cannot possibly help everyone in every part of the world, but we certainly do what we can within our own means. It has been our honour for over a decade now to provide funding for IFIC scholarships, which bring attendees to the IFIC conference who might otherwise not be able to participate. Many of our chapters also support the IFIC scholarship through their individual donations, and the Board of IFIC gratefully acknowledged them. The enthusiasm and optimism of those mostly new infection prevention and control professionals attending this prestigious international conference is certainly a bug we want to catch.

The South African Infection Control Association will hold its conference in Johannesburg, South Africa in September 2016. One of the workshops being planned is designed to assist struggling countries with the creation of professional networking and education associations. Our 40 years as a professional organization have flown by and we do not forget the strength of purpose required by our pioneers in forming such an important body. The will to stand together to gain the wisdom to fight infections, to educate healthcare providers, and to reassure patients, residents and families that we are there to protect, continues to be a wonder. 🍁

“The will to stand together to gain the wisdom to fight infections, to educate healthcare providers, and to reassure patients, residents and families that we are there to protect, continues to be a wonder.”

# WORKING HARD TO ACHIEVE HAND HYGIENE COMPLIANCE?



## WE'LL HELP YOU WORK SMARTER.

With hand hygiene compliance rates at lower than 50% nationwide, maybe it's time to work smarter. GOJO® SMARTLINK™ Hand Hygiene solutions combines 24/7 monitoring with the industry's most trusted sanitizers, soaps and dispensers, plus clinician-based on-site support. The new electronic Observation System collects and reports hand hygiene and PPE. It's an innovative hand hygiene compliance monitoring system that represents the most comprehensive way to achieve optimum compliance levels.

Call **800-321-9647** today to learn more about SMARTLINK™ solutions. It could be one of the smartest calls you ever make.

Start making a difference today.  
**REQUEST A FREE TRIAL AT [SMARTLINK@GOJO.COM](mailto:SMARTLINK@GOJO.COM)**  
or visit [www.GOJOCanada.ca/SMARTLINK](http://www.GOJOCanada.ca/SMARTLINK).

Intelligent. Intuitive. Insightful.



# 2016 Annual General Meeting

**NOTICE IS HEREBY SERVED** that the Annual General Meeting (AGM) of Infection Prevention and Control Canada will be held on Wednesday, May 18, 2016 at the Scotiabank Convention Centre, Niagara Falls, Ontario. Breakfast will be served at 0715. Registration will open at 0700. IPAC Canada members must register and pick up a voting card before entering the AGM. The AGM will commence at 0745. Registration will close at 0745 and the doors will be closed. After the doors are closed, attendees may enter the AGM, but may not vote unless registered.

Members may vote on business arising at the AGM by proxy using Form #15 2016 which must be submitted to the IPAC Canada Secretary at the IPAC Canada office no later than Thursday, May 12, 2016. The AGM Agenda, Rules of Order and Proxy Form #15 2016 will be posted to the website in early 2016 and an announcement made of their availability. 🌸



Wisdom Begins With Wonder  
IPAC CANADA

Registration Brochure available at  
[www.ipac-canada.org](http://www.ipac-canada.org)

Marilyn Weinmaster, Secretary  
IPAC Canada  
Email: [executivedirector@ipac-canada.org](mailto:executivedirector@ipac-canada.org)  
Fax: 1-204-895-9595



# 2016 National Education Conference

We wish to thank our generous sponsors for their support of the 2016 IPAC Canada conference (at time of printing):

## PLATINUM



## SILVER



## BRONZE



## SPONSOR





# Kleanik™

SINK DISINFECTION SYSTEM

**WIN THE WAR  
NOT the Battle!**



**Eliminate the problem at the source. Don't let it come back.**



### What does Kleanik do?

- Prevents spread of Waterborne Infections
- Kills bacteria **continuously** with no human effort
- Prevents **Biofilm** formation through **heat and electro-mechanical vibrations**
- **No Consumables** required

**Come take a look at the IPAC 2016 tradeshow!  
BOOTH #71**

**safe-soak**

**Your #1 Fluid Waste Management Solution**



Place your order online!  
[www.SAFE-SOAK.com](http://www.SAFE-SOAK.com)



# Wisdom Begins With Wonder

IPAC CANADA

## Exhibitors

\*Interactive exhibit floor plan will be included in the conference app.

\*\*Exhibitors highlighted with logos and yellow screens are advertisers appearing in this issue of CJIC.

**3M** Booths 65, 76

**3M Canada**  
519-452-2500  
[acasson@mmm.com](mailto:acasson@mmm.com)  
3M's Infection Prevention Division offers healthcare professionals a leadership solution to help achieve Surgical Care Excellence and aid in minimizing the risk of surgical site infections.

**Abatement Technologies** Booth 68  
800-827-6443  
[bworrall@abatement.ca](mailto:bworrall@abatement.ca)

**Alere Canada** Booth 2  
613-271-1144  
[kim.orr@alere.com](mailto:kim.orr@alere.com)

**ArjoHuntleigh Canada** Booths 26, 27  
905-238-7880  
[Esther.Zhao@ArjoHuntleigh.com](mailto:Esther.Zhao@ArjoHuntleigh.com)

**Bard Canada Inc.** Booth 75  
647-629-1012  
[derrick.nield@crbard.com](mailto:derrick.nield@crbard.com)

**Baxter** Booth 53

**Baxter Healthcare**  
905-369-6000  
[hospitalcare@baxter.com](mailto:hospitalcare@baxter.com)  
Broad portfolio of essential renal and hospital products, including home, acute and in-center dialysis; sterile IV solutions; infusion systems and devices; parenteral nutrition; biosurgery products and anesthetics; and pharmacy automation, software and services.

**BD Canada** Booth 64  
905-288-6118  
[jackie\\_allan@bd.com](mailto:jackie_allan@bd.com)

**Bowers Medical - MAXAIR** Booth 80  
888-216-4833  
[strentse@sympatico.ca](mailto:strentse@sympatico.ca)

**CADTH** Booth 37  
613-226-2553  
[joseen@cadth.ca](mailto:joseen@cadth.ca)

**Canadian Association of Environmental Management** Booth 85  
519-993-2590  
[keithsopha@cleanlearning.org](mailto:keithsopha@cleanlearning.org)

**Canadian Association of Medical devices Reprocessing (CAMDR)** Booth 9  
416-480-6100  
[abdool.karim@sunnybrook.ca](mailto:abdool.karim@sunnybrook.ca)

**Canadian Patient Safety Institute** 37A  
[BLFort@cpsi-icsp.ca](mailto:BLFort@cpsi-icsp.ca)  
780-409-8090

**CardioMed Supplies Inc.** Booth 7  
705-328-2518  
[raphael@cardiomed.com](mailto:raphael@cardiomed.com)

**CBIC** Booth 18  
414-918-9796  
[cdavis@cbic.org](mailto:cdavis@cbic.org)

**Christie Innomed** Booth 66  
514-217-6918  
[jmokbel@christieinnomed.com](mailto:jmokbel@christieinnomed.com)

**CLOROX HEALTHCARE\*** Booths 41, 42, 55, 56

**Clorox Professional Products Company**  
866-789-4973  
[healthcare@clorox.com](http://healthcare@clorox.com)  
Clorox Healthcare® markets some of the most trusted healthcare brands in North America. With a portfolio that includes bleach, hydrogen peroxide and quaternary products, we offer many solutions that reinforce our commitment to helping healthcare professionals stop the spread of infections.

**Cornerstone Medical** Booths 38, 39, 40  
905-945-2522  
[dthibault@cornerstone-medical.com](mailto:dthibault@cornerstone-medical.com)

**CSA Group** 38A  
416-747-4005  
[cecilia.vega@csagroup.org](mailto:cecilia.vega@csagroup.org)

**Crede Technologies Inc.** Booth 1  
604-828-8945  
[peter.kaloupis@gmail.com](mailto:peter.kaloupis@gmail.com)

**Daniels Health | Canada** Booth 52  
905-488-1474  
[ijennings@danielshealth.ca](mailto:ijennings@danielshealth.ca)

**debmed** Booths 20, 33

**DebMed**  
519-443-8697  
[brittany.taylor@debmed.com](mailto:brittany.taylor@debmed.com)  
Offering the most comprehensive hand hygiene solution, including an electronic hand hygiene compliance monitoring system and full line of skincare products designed for healthcare, including point-of-care dispensers and Optidose, which helps achieve the WHO best practices.

**Detecto Scale** Booth 73  
417-673-4631  
[llihou@cardet.com](mailto:llihou@cardet.com)

**Ecolab** Booths 49, 50  
678-896-4202  
[susan.peszko@ecolab.com](mailto:susan.peszko@ecolab.com)



**Emerald Health Information Systems** Booth 10  
613-599-8178  
[saly@emeraldhis.com](mailto:saly@emeraldhis.com)

Canadian health informatics company specializing in infection control and surveillance, patient flow, workload and BI software solutions. Our Infection Control and Surveillance solution integrates microbiology data with registration, pharmacy and OR data to provide both real time and historical views.



**GOJO Industries, Inc.** Booths 30, 31, 32  
800-321-9647  
[gocanada@gojo.com](mailto:gocanada@gojo.com)

Your partner in hand hygiene to help increase compliance, reduce infections and improve patient outcomes through preferred products, advanced dispensing systems, customizable electronic compliance monitoring solutions and educational programs.

**healthHcentric** Booths 60, 81  
905-696-6800  
[alison.duffy@ergocentric.com](mailto:alison.duffy@ergocentric.com)

**Hill-Rom Canada** Booth 90  
416-371-5842  
[michael.aguiar@hill-rom.com](mailto:michael.aguiar@hill-rom.com)



**Hygie Canada** Booth 48  
450-444-6777  
[info@hygie.com](mailto:info@hygie.com)

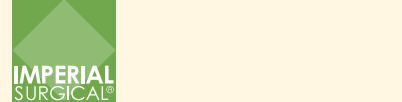
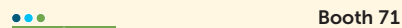
Worldwide leader in specialty products that effectively manage biological fluids, thus limiting the spread of bacteria and reducing the risk of hospital infections. Its unique HY21 Technology consists of hygienic supports and liners for bedpan, urinal and emesis as well as an aluminum revolutionary commode chair.



**Hygiene Performance Solutions Inc.** Booth 92  
905-361-8749

[info@hygienep performancesolutions.com](mailto:info@hygienep performancesolutions.com)  
Consulting firm and performance coaching team specializing in custom facility, environmental and clinical support services solutions for the hospital, long term care and retirement living sector.

**Immunize Canada** Booth 17  
613-725-3769  
[loconnor@cpha.ca](mailto:loconnor@cpha.ca)



**Imperial Surgical Ltd.** Booth 71  
514-631-7988  
[sdelisio@surgmed.com](mailto:sdelisio@surgmed.com)

Specializes in the fabrication of stainless steel equipment. Among our products; Kleanik™ is a revolutionary automated sink disinfection system that works continuously to prevent transmission of deadly bacteria that cause serious and fatal infections.

**Inter Medico** Booth 29  
905-470-2520  
[lpuma@inter-medico.com](mailto:lpuma@inter-medico.com)

**International Federation of Infection Control (IFIC)** Booth 19  
304-388-4259  
[tleewv@msn.com](mailto:tleewv@msn.com)

**Invacare Canada LP** Booth 86  
905-890-8300  
[chodgkin@invacare.com](mailto:chodgkin@invacare.com)

**IPAC Canada** Booths 11-15  
[www.ipac-canada.org](http://www.ipac-canada.org)

**Kimberly-Clark Professional** Booths 57, 58  
647-278-9387  
[matthew.d.freeman@kcc.com](mailto:matthew.d.freeman@kcc.com)

**Kontrol Kube by Fiberlock** Booth 61  
800-342-3755  
[cbrooks@fiberlock.com](mailto:cbrooks@fiberlock.com)

**Lalema Inc.** Booth 6  
514-645-2753  
[mlandry@lalema.com](mailto:mlandry@lalema.com)

**Médic Accès** Booth 44  
877-782-3017  
[admin@medicacces.com](mailto:admin@medicacces.com)

**mAiRiner Infection Prevention & Control Solutions** Booth 4  
416-677-7001  
[bkyle@mairiner.com](mailto:bkyle@mairiner.com)

**Medela Canada** Booth 83  
800-435-8316  
[regine.lalancette@medela.ca](mailto:regine.lalancette@medela.ca)

**Medical Device Reprocessing Association of Ontario** 60A  
7052684763  
[mdrao@ntl.sympatico.ca](mailto:mdrao@ntl.sympatico.ca)

**Medical Mart** Booth 5  
905-624-6200  
[marketing@medimart.com](mailto:marketing@medimart.com)

**MEDIQUE Medical Supplies (MGBR) Inc.** Booth 3  
514-342-4294  
[nathalie@mediquemed.com](mailto:nathalie@mediquemed.com)

**Medline Canada** Booth 23  
905-636-2120  
[jrasavong@medline.com](mailto:jrasavong@medline.com)

**Metrex** 59A  
714-817-5430  
[Denise.Montenegro@metrex.com](mailto:Denise.Montenegro@metrex.com)



**Micrylium** Booth 67  
416-667-7040  
[info@micrylium.com](mailto:info@micrylium.com)  
Globally focused infection control manufacturer. Disinfection in one step. Fully biodegradable green team products. World's fastest tuberculocide.

**MIP Inc.** Booths 69, 70  
514-356-1224  
[kbruce@mip.ca](mailto:kbruce@mip.ca)

**Moleculight Inc.** Booth 84  
416-673-6515  
[catherinet@moleculight.com](mailto:catherinet@moleculight.com)

**Nanosonics** Booth 94  
844-876-7466  
[p.patole@nanosonics.com.au](mailto:p.patole@nanosonics.com.au)

**Olympus Canada** Booth 62  
289-269-0204  
[roxanne.deabreu@olympus.com](mailto:roxanne.deabreu@olympus.com)

**Pall Medical** Booths 35, 36  
613-291-2870  
[matthew\\_antoine@pall.com](mailto:matthew_antoine@pall.com)

**PINCHIN** Booth 74

**Pinchin Ltd.**  
905-363-0678  
[bsiedlecki@pinchin.com](mailto:bsiedlecki@pinchin.com)

One-stop approach to environmental and health & safety, providing a variety of consulting and management services specifically designed for healthcare facilities. This includes Legionella consulting and laboratory services, managing healthcare construction and renovation projects as per CSA Z317.12, training, etc.

**priMED** Booth 93

**priMED Medical Products Inc.**  
780-784-2268  
[irene.tong@primed.ca](mailto:irene.tong@primed.ca)

**PCS** Booth 72

**Process Cleaning Solutions**  
877-745-7277  
[service@processcleaningsolutions.com](mailto:service@processcleaningsolutions.com)

Canadian company devoted to cleaning in such a way as to: Protect public health, Protect the most sensitive among us, Protect the environment and to prevent the spread of antibiotic resistant bacteria.

**Public Health Ontario** Booth 16

647-260-7249  
[stefani.margulies@oahpp.ca](mailto:stefani.margulies@oahpp.ca)

**RL Solutions** Booth 63

416-410-8456  
[fernanda@rlsolutions.com](mailto:fernanda@rlsolutions.com)

**SAGE** Booth 59

**Sage Products**  
800-323-2220  
[customerservice@sageproducts.com](mailto:customerservice@sageproducts.com)

Leading developer of preventative healthcare products used by healthcare professionals, family caregivers and patients around the world. Our mission is to solve real problems in healthcare through innovative products and services that reduce risk factors for hospital-acquired infections, patient skin injury and healthcare worker injury.

**SciCan** Booths 21, 22

A Sanavis Group Company

**SciCan Ltd.**  
416-445-1600  
[phennessy@scican.com](mailto:phennessy@scican.com)

Full spectrum infection control solutions provider working together with industry professionals and regulators to provide the market with the most innovative and effective products available. Products include plasma sterilizers, endoscope reprocessors, gas monitoring systems, rotary heat sealers, endoscope cabinets, bedpan washer disinfectors, scope porters and pulsed xenon UV disinfection devices.

**Sealed Air** Booths 87, 88, 89

Diversey Care

**Sealed Air Diversey Care**  
800-668-7171  
[larinda.becker@sealedair.com](mailto:larinda.becker@sealedair.com)

Cleaning hygiene solutions offering expertise in disinfection cleaning solutions, dosing and dispensing technologies and consulting services.

**Solaris UV Technologies** Booth 82

647-984-1570  
[steinhoff.adam@gmail.com](mailto:steinhoff.adam@gmail.com)

**Southmedic Inc.** Booth 46

705-720-1902  
[jmcunningham@southmedic.com](mailto:jmcunningham@southmedic.com)

**STERIS** Booth 34

**STERIS Canada, Inc.**  
905-362-6233  
[antoinette\\_rokicki@steris.com](mailto:antoinette_rokicki@steris.com)

Pathogen UVC Antimicrobial System, System 1 EXPRESS endoscope sterilization systems, protein detection for routine surveillance and automated cleaning detergent dilution systems will be featured products.

**Surgically Clean Air Inc.** Booth 51

877-440-7770  
[doug@surgicallycleanair.com](mailto:doug@surgicallycleanair.com)

**STEVENS** Booth 45

**The Stevens Company Limited**  
905-791-8600  
[marketingdepartment@stevens.ca](mailto:marketingdepartment@stevens.ca)

Pillar in Canadian healthcare since 1874; one of the largest medical supply distributors in Canada today. Originally founded in 1830 in London, England, it is still owned and operated by the Stevens family, now in its 6th generation. Distributions centres in Brampton, Vancouver, Calgary, Winnipeg, Halifax, and Montreal.

**Vantage Endoscopy** Booth 24

866-677-4121  
[jefff@vantageendoscopy.com](mailto:jefff@vantageendoscopy.com)

**Vernacare** Booths 43, 54

**Vernacare**  
416-661-5552  
[michelle\\_lawrence@vernacare.com](mailto:michelle_lawrence@vernacare.com)

Established world leader providing environmentally responsible solutions for human waste disposal to help improve infection control.

**Vileda Professional** Booth 47

905-669-9949  
[andres.lelarge@fhp-ww.com](mailto:andres.lelarge@fhp-ww.com)

**VIROX** Booths 77, 78, 79

**Virox Technologies Inc.**  
905-813-0110  
[mpetkovic@virox.com](mailto:mpetkovic@virox.com)

We equip the entire spectrum of global markets concerned with infection control with state of the art antimicrobial technology accelerated hydrogen peroxide.

**Webber Training Inc.** Booth 25

613-962-0437  
[paul@webbertraining.com](mailto:paul@webbertraining.com)

**Weever Apps** Booth 28

905-218-6584  
[steve@weeverapps.com](mailto:steve@weeverapps.com)

**Wood Wyant Inc.** Booth 8

819-758-2889  
[melanie.moreau@sanimarc.com](mailto:melanie.moreau@sanimarc.com)

**XENEX** Booth 91

GERM-ZAPPING ROBOTS™

**Xenex Disinfection Services**  
800-553-0069  
[info@xenex.com](mailto:info@xenex.com)

Offers the only Pulsed Xenon Full Spectrum™ UV disinfection system to quickly eliminate harmful bacteria, viruses and spores that cause hospital acquired infections (HAIs). Published peer reviewed outcome studies conducted by hospitals using Xenex show reductions up to 70% hospital acquired C. diff and MRSA infection rates and a 100% decrease in total joint Surgical Site Infections (SSIs).



## YOUR NEW MOP

The new Maximizer Mop's built-in cleaning efficiency makes even the biggest jobs seem small.



# 30%

MORE FLOOR  
COVERAGE



25% LESS  
WEIGHT





## 2016 Sage Products LLC International Attendee Scholarship

---

The following infection prevention and control professionals have been awarded the 2016 Sage Products LLC International Attendee Scholarship. They will both attend the 2016 conference in Niagara Falls. IPAC Canada thanks Sage Products LLC for making this prestigious scholarship possible.



**HILDA OROZCO, MD**  
Mexico City, Mexico

Dr. Orozco is with the National Pediatric Institute "Instituto Nacional de Pediatría" and is Head of the Infectious Committee. She has been in infection prevention and control for more than five years.

As Head of the Infectious Committee, her responsibilities are surveillance, education for healthcare workers, students, residents and visitors, determining strategies to prevent risk, implement policies, implementing a hand hygiene program, and publish research and data. She has been a presenter at many conferences in Mexico and Central America. She is a Professor at St. Jude Children's Research Hospital in Mexico. She is a member of the Asociación Mexicana para el Estudio de Infecciones Nosocomiales.

### **MYRIAN SCHERER**

Infection Control Nurse, Buenos Aires, Argentina

Ms. Scherer is with the Medical Direction Department at Instituto Argentino de Diagnóstico y Tratamiento. She is certified in infection control and has been in infection control for more than sixteen years. She is a member of the Asociación Argentina de Enfermeros en Control de Infecciones (ADECI).

Myrian was co-director of the National Hand Hygiene Campaign in 2010 and co-investigator in the Argentinean Hand Hygiene Improvement Multicenter Study. She has published several times and acted as a presenter at many national conferences. \*



**MAXIMIZED**

---

[rubbermaidcommercial.com](http://rubbermaidcommercial.com)

---





**Eliminates 99.999% of MRSA and VRE**

**Eliminates 99.99% of *C. diff* spores**

**Eliminates 99.999% of Viruses**

Independent studies prove PATHOGON™ UV Antimicrobial System is effective against pathogens that can cause healthcare associated infections (HAI).

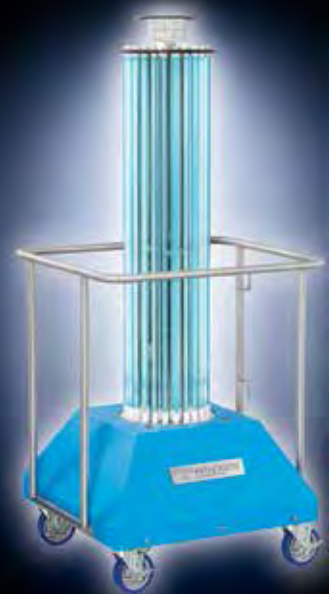
Start winning the fight against invisible infectious pathogens today with STERIS's own PATHOGON UV Antimicrobial System.

**PATHOGON™**  
UV Antimicrobial System

By STERIS, the leader in  
Infection Protection.



**Request a quote today  
at [www.pathogon.com](http://www.pathogon.com)!**



 **STERIS**

STERIS Canada Inc. | Healthcare  
375 Britannia Road East, Unit 2  
Mississauga, ON L4Z 3E2 Canada  
800 661 3937

[www.steris.com](http://www.steris.com) <<http://www.steris.com>>

# 2016 SealedAir Diversey Scholarship

**T**hrough the generous support of SealedAir Diversey, 16 IPAC Canada members have been supported to attend the 2016 annual conference. The recipients include members with novice, intermediate, and advanced expertise. IPAC Canada thanks SealedAir Diversey for the opportunity for selected candidates to have the support needed to attend the conference. We commend all applicants for the quality of their work in infection prevention and control. Watch for an announcement of the 2017 scholarship guidelines. **Deadline date for 2017 scholarship: January 31, 2017.**

**Melissa Botz**, Barry's Bay, Ontario

**Blanda Chow**, Calgary, Alberta

**Adel Coulter**, Owen Sound, Ontario

**Betty Anne Elford**, Corner Brook, Newfoundland and Labrador

**Lola Gushue**, Gander, Newfoundland Labrador

**Catherine Kerr**, Mississauga, Ontario

**Mary LeBlanc**, O'Leary, Prince Edward Island

**Sheila Lee**, Bridgewater, Nova Scotia



**Debbie McIntyre**, Brockville, Ontario

**Devon Metcalf**, Guelph, Ontario

**Tracey Reid**, Corner Brook, Newfoundland and Labrador

**Cheyenne Roth**, Regina, Saskatchewan

**Christine Sherren**, Halifax, Nova Scotia

**Dori Taylor**, Varna, Ontario

**Michele Terfry**, Eastern Passage, Nova Scotia

**Catherine Van Arkel**, Chatham, Ontario 



## STANDARDS SOLUTIONS FOR STERILIZATION IN HEALTH CARE SETTINGS

The **Z314 Series** of standards work to ensure that the reprocessing of reusable medical devices meets minimum requirements to help ensure the safety of patients and the delivery of reliable health care services.

Included in these series is the latest edition of **Z314.22 - Management of Loaned, Reusable Medical Devices**.

**Learn More**



[shop.csa.ca](http://shop.csa.ca)



(800) 463 6727



**FREE!**  
FIND OUT  
WHAT'S IN  
YOUR BASINS

(see below)



## Replace your basins with a rinse-free hygienic system

Basins may contain pathogens associated with hospital-acquired infections (HAIs).<sup>1,2</sup> Need more proof? We'll sample your basins for FREE!

Replace your basins now. Our comprehensive, rinse-free patient cleansing products can help standardize patient care and may address a risk factor for CAUTI through eliminating the basin.<sup>3</sup>



**Sign up for FREE basin sampling!**  
Visit [sageproducts.com/Basin-Sampling](http://sageproducts.com/Basin-Sampling)  
or call 800.323.2220

REFERENCES: 1. Marchaim D, et al., Hospital bath basins are frequently contaminated with multi-drug resistant human pathogens. Poster presented at SHEA 21st Annual Scientific Meeting, April 2011. 2. Johnson D, Lineweaver, Maze L, Patients' bath basins as potential sources of infection: a multi center sampling study, AJCC, Vol 18, No 1, Jan 2009. 3. Stone S, et al., Removal of bath basins to reduce catheter-associated urinary tract infections. Poster presented at APIC 2010, New Orleans, LA, July 2010.

**SAGE**  
PRODUCTS



# Elections to Board of Directors

The following candidates have been nominated for positions open on the Board of Directors in 2016. Additional nominations may be presented by not less than two IPAC Canada at the Annual General Meeting (**Wednesday, May 18, 2016, Niagara Falls**). Additional nominees must be present to confirm their willingness to be nominated, or just have provided a written confirmation to the nominator(s).

## **DIRECTOR** (three-year term) (Programs and Projects)

### **Mandy Deeves, BScN, RN, CIC**

Network Coordinator, Public Health Ontario  
North Simcoe Muskoka Infection Control Network  
Orillia, Ontario

## **DIRECTOR** (three-year term) (Standards & Guidelines)

### **Tara Donovan, BHSc, MSc**

Epidemiologist  
Fraser Health  
Surrey, British Columbia

## **PUBLIC REPRESENTATIVE** (three-year term)

**Nominations accepted by May 1, 2016**

## CANDIDATE PROFILES



### **MANDY DEEVES, BScN, RN, CIC**

is nominated for her second term as a Director of IPAC Canada with responsibilities for Programs & Projects. Mandy is Network Coordinator, Public Health Ontario – North Simcoe Muskoka Infection Control Network, Orillia, Ontario. She has been in

Infection Prevention and Control for nine years and has been an IPAC Canada member during that time. Her role at the Network is to provide a specialized range of evidence-based, educational and consultative services to Infection Prevention and Control staff, management and front-line healthcare providers in regional and provincial stakeholder organizations. Mandy was instrumental in the formation of IPAC Simcoe Muskoka chapter and has served as its President. Her responsibilities as a Director of IPAC Canada have included oversight of the Programs and Projects Committee and she has served as Chair of the Programs and Projects Core Committee.

**Philosophy:** Over the past three years, I have worked with members of the Board of Directors of IPAC Canada to represent the needs of our membership, working to promote resources and/or create tools that will assist them in meeting IPAC needs. Working with infection prevention and control professionals across the continuum of care, has afforded me the opportunity to better understand the IPAC challenges faced in these different sectors. As the chair of the Programs & Projects Committee, I will continue to support the work that is being done by this organization to maintain and support projects developed by our membership.

In the role of Director, I hope to continue to promote both IPAC Canada and the practice of IPAC by encouraging exchange of knowledge, experience, ideas and information for the prevention and control of infections as well as collaboration and networking among persons interested in Infection Prevention and Control.



### **TARA DONOVAN, BHSc, MSc**

completed an MSc in Community Health and Epidemiology in 2007 at Queen's University in Kingston Ontario. Motivated by her interest and a desire to continue learning, Tara completed a Certificate in Infection Control at Queen's University. She began her

career as the Communicable Disease Epidemiologist with the Kingston, Frontenac, Lennox and Addington Public Health Unit and particularly focused on the monitoring and evaluation of a real-time syndromic surveillance system. In 2009, Tara accepted a contract position and moved across the country to work with the Immunization Program at the BC Centre for Disease Control as a Vaccine-Preventable Disease Epidemiologist. Following the contract term, Tara joined Fraser Health Authority in 2010 as the Regional Epidemiologist for Infection Prevention and Control. Her primary role was to lead, direct and provide expertise in the development, implementation, maintenance and ongoing evaluation of a Regional Infection Prevention and Control Surveillance Program. Tara has recently taken a Managing Consultant position with the Fraser Health IPAC program and will continue to collaborate with team members and stakeholders to enhance and maintain surveillance initiatives as well as pursue other important projects to drive quality improvement and patient safety. Tara co-chaired the Surveillance and Applied Epidemiology Interest Group in 2012 and 2013. She is actively involved with the IPAC BC Chapter having served as Treasurer and then President for three years respectively. Tara has provided both poster and oral presentations at the IPAC Canada National Conferences in recent years and has been the Module 4 instructor for the IPAC Canada Novice Infection Prevention and Control course since 2012.

**Philosophy:** If I am granted the opportunity to hold a Director position with IPAC Canada, I pledge to actively communicate and collaborate with my fellow Board members to achieve results and maintain the values of the association. I would focus my efforts as liaison with the standards and guidelines committee as this group plays a crucial role as reviewer and generator of guidelines as requested by IPAC Canada members. I would be dedicated to employing critical thinking when making decisions in the Director role. I would strive to give effective and timely feedback in order to continue momentum and create resources that support members in their endeavours to uphold patient and staff safety by fortifying best practices. IPAC professionals strive to do the right thing at the right time and this is also my commitment in the role of Director. ✨

NOW LAUNCHED

# IPAC CANADA LEARNING OBJECT REPOSITORY

**"ALONE WE ARE SMART.  
TOGETHER WE ARE BRILLIANT."**

– S. Anderson, Educator

- ▶ A repository for digital learning objects
- ▶ For teaching and learning
- ▶ Created by IPAC Canada members



For information see the Learning Object Repository page at [http://www.ipac-canada.org/Members/members\\_LOR.php](http://www.ipac-canada.org/Members/members_LOR.php)

## IC|NET

CLINICAL SURVEILLANCE SOFTWARE FOR  
INFECTION PREVENTION | PHARMACY | SURGICAL OUTCOMES

ICNet surveillance software provides you the insight to make more informed decisions on medication usage and infection control.

**THE DATA YOU NEED. WHEN YOU NEED IT.**

Visit [www.baxter.ca](http://www.baxter.ca) for further information.

**Baxter**

Baxter, ICNet and ICNet logo are trademarks of Baxter International Inc., or its subsidiaries.

CAMP/MG1/16-0030 3/16

## Demonstrate Due Diligence.

Manage risks of Legionella in building water systems.



### Pinchin provides Canada Wide Legionella consulting and analytical services

- Proactive & reactive risk assessments
- Preventive management programs
- Training on Legionella management
- Legionella analytical services

### Pinchin's Legionella laboratory is:

- AIHA LAP LLC Accredited
- CDC ELITE Certified
- Quebec Government Accredited Laboratory



[pinchin.com](http://pinchin.com) | 1.855.PINCHIN

## Biofilms are forming on many dry hospital surfaces because they aren't cleaned frequently or effectively enough.

The bacteria have a chance to attach and excrete extracellular organic substances, or slime, which makes them more resistant to removal and tolerant to disinfectants.

### Process used by bacteria to form biofilms on dry surfaces

- Individual bacterial cells land on a surface.
- Some attach to surface, and may be aided by organic chemical or soil residues.
- Attached bacteria release extracellular organic substances which allow additional mixed bacteria to adhere to the colony being formed.
- Biofilm bacterial communities shed bacteria back into the environment
- Once the bacterial community has matured the bacterial population is protected from cleaning processes and biocides.



## PCS OFFERS TWO OPTIONS TO ADDRESS ACCUMULATED FIXED ORGANIC SOILS FROM SURFACES.

### 1 - PCS Prevention Process

Frequent cleaning with PCS microfibre cloths and PCS 7000 Oxidizing Disinfectant/Disinfectant Cleaner diluted to the cleaning and sanitizing solution of 200 ppm of sodium hypochlorite.

Frequently damp wiping surfaces with this process keeps organic soils oxidized and our microfibre cloths add the friction needed to remove and prevent organic soils from accumulating.

PCS 7000 cleaning and sanitizing solution has demonstrated a greater than 7 log reduction in Staphylococcus aureus and Escherichia coli in 30 seconds (Germicidal and Detergent Sanitizing Action of Disinfectants). Approved and recommended for no rinse sanitization of pre cleaned direct food contact surfaces.

Unlike detergents and disinfecting detergents PCS 7000 contains no organic substances that microbes could consume the residues as a nutrient source.

#### The process

- ✓ Dampen PCS microfibre cloths in a solution containing 200 ppm of PCS stabilized sodium hypochlorite solution.
- ✓ Double wipe surfaces applying pressure to maximize removal of soil.
- ✓ Oxidizing cleaning without depositing organic chemicals.

PCS 7000 Disinfectant Cleaner is a stable formulation with a 24 month shelf life.

#6063-6 • 6 x 946 mL w/ flip top  
#6030-4 • 4 x 3.78 L closed loop

#6030-RC • 4 x 2.5 L

#### PCS Disinfectant Application Cloths

#6067 • 7" x 12" 100/container x 6/case

#6068 • 12" x 12.5" 110 per container x 4/case

#### Microfibre Cloths

#PCSMF-BL Blue

#PCSMF-R Red

#PCSMF-G Green

#PCSMF-Y Yellow

### 2 - PCS Deep Cleaning Process

For added efficacy during persistent outbreaks and to oxidize and remove accumulated organic soils. Organic soils or mature biofilms resist cleaning and disinfecting and there is evidence bacteria lodged within biofilms can be up to 1000 times more resistant to disinfecting chemicals.

#### The Process

- ✓ Apply PCS 7000 Disinfectant Cleaner with PCS Disinfectant Application cloths
- ✓ Keep surfaces wet for five minutes to kill C difficile spores and to oxidize accumulated organic soils.
- ✓ To prevent oxidized organic soils from reattaching wipe surfaces with a PCS microfibre cloth dampened in cleaning and sanitizing solution of 200 ppm of PCS 7000.

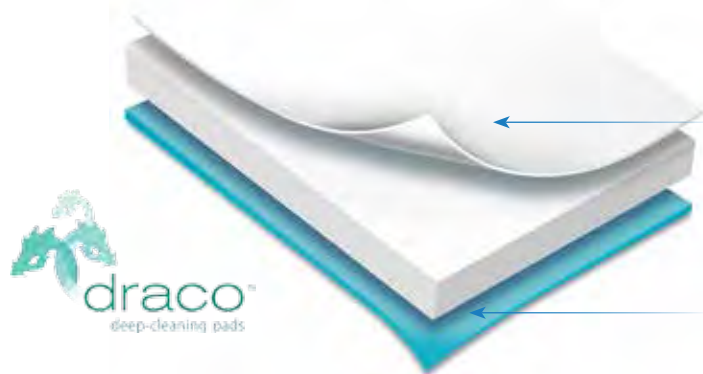
\*Alternatively PCS 7000 can be applied undiluted to a pre dampened PCS microfibre cloth.

There is evidence concentrations of sodium hypochlorite can oxidize biofilms matrix therefore adding a damp wiping step after disinfection will improve the removal of organic soils.



# Attack Biofilm

Detach → Capture → Remove



**Scrubbing Foam Layer:** Non-abrasive scrubbing at a microscopic level, proven to detach Biofilm which detergent alone cannot.

**Microfiber Layer:** Split microfiber layer captures microscopic particles as small as 4 microns.

*Draco hand pad is compatible with any detergent or disinfectant • now available in our bestselling flexible endoscope First Step Bedside Pre-Clean Kit!*



# Scope Transport

**NEW! Single-Use Rigid Containment**

- Oasis Scope Transport Trays: comply with CSA transport standards.
- Built-in reservoir for bed-side pre-clean.
- A reversible lid identifying clean & soiled scope.
- Stackable for storage, a variety of carts for storage also available.
- Eco-friendly: made with renewable resources & 100% biodegradable.

## COMPARATIVE TEST STUDY –

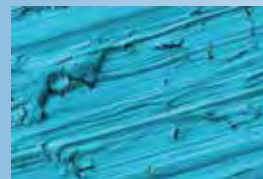
Center for Biofilm Engineering, Montana State University – study done using Biofilm kill claim detergent.



**Control**  
6000 x Magnification



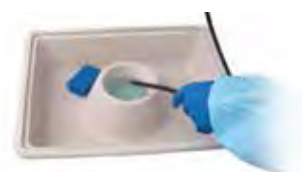
**Traditional Urethane Pad**  
Wiped Twice  
6000 x Magnification



**Draco Deep Cleaning Pad**  
Wiped Twice  
1 x Scrubbing Foam Side  
1 x Microfiber Side  
6000 x Magnification

## Capture → Remove → Dispose

- Single-use: prevents cross contamination.
- Split microfiber technology captures spores & pathogens at a microscopic level (C.Diff, VRE, CRE, & Norovirus).
- Compatible with any detergent and disinfectant.
- Available sterile for use in the OR.





Our vision is an **80% reduction** in Healthcare Acquired Infections by **2024**

- 200,000 people in Canada get an infection from a hospital each year
- 5% (10,000!) will die
- Healthcare acquired infections costs us \$4-5billion EACH year

**Join the Coalition for Healthcare Acquired Infection Reduction (CHAIR)**

A not-for-profit professional and industry organization dedicated to reducing HAI in Canadian healthcare facilities through engineered solutions including: antimicrobial surface coatings, UV technology, downdraft ventilation and more.

Find out more at [www.chaircanada.org](http://www.chaircanada.org)



**CHAIR**

Coalition for Healthcare Acquired Infection Reduction

[www.chaircanada.org](http://www.chaircanada.org)



Photograph:  
The Stevens / Meiko Project  
Oakville, Ontario



**STEVENS**

"Where service is a commitment"



The clean solution

**TopLine**

Expanding the boundaries of patient-focused solutions

Patient-focused solutions are an increasingly popular choice when it comes to planning infection control systems in hospitals. By integrating bedpan washer/disinfectors in ensuite bathrooms or directly in patients' rooms, these new solutions maximize hygiene by minimizing the distance bedpans are transported.

The MEIKO TopLine 30 is a perfect example. This wall-mounted cleaning and disinfection appliance offers state-of-the-art technology and an impressive array of design options to suit any environment. TopLine technology has earned our customers' trust and loyalty all over the world. From stand-alone appliances and combined care units to fully-fitted utility rooms, MEIKO TopLine offers top-quality clean solutions custom-made to your specifications. Consistently hygienic, economical and user-friendly, MEIKO TopLine is the clean solution from MEIKO.



[www.stevens.ca](http://www.stevens.ca)

<b>HALIFAX</b> 800-565-0765	<b>MONTREAL</b> 855-660-7750	<b>TORONTO</b> 800-268-0184	<b>WINNIPEG</b> 800-665-0368	<b>CALGARY</b> 800-665-0368	<b>VANCOUVER</b> 800-565-8444
--------------------------------	---------------------------------	--------------------------------	---------------------------------	--------------------------------	----------------------------------

# Not All Wipes are Created Equal

## Choose Blue

### Choose 3M™ Surface Disinfectant Cleaner Wipes

(DIN 02354381)



**Bactericidal, Fungicidal,  
Virucidal, Tuberculocidal<sup>1</sup>**  
Because you never know  
what is living on your surfaces



**Doesn't damage surfaces<sup>2</sup>**  
Because we know how fragile your  
equipment can be



**Three Minute Contact time<sup>3</sup>**  
Because we know your time  
is important



**Unique blue colour**  
Because we know your patient's  
safety is important

Test your knowledge, by taking  
the 3M Wipe Challenge at

[www.3M.ca/wipechallenge](http://www.3M.ca/wipechallenge)

or call your 3M representative for further  
information at 1-800-364-3577.



3M Science. Applied to Life.™

3M and 3M Science. Applied to Life. are trademarks of 3M.  
Used under license in Canada. Please recycle. Printed in Canada.  
© 2018, 3M. All Rights reserved. 160204725-E BA-16-21096

Internal data on file.  
Internal data on file.  
Internal data on file.

# Marion Yetman Appointed Honorary Member

The Board of Directors of IPAC Canada are very pleased to announce that Marion Yetman, RN, BN, MN, CIC has been appointed an Honorary Member. Marion was nominated for honorary membership by her chapter, IPAC Newfoundland Labrador.

Marion has been in Infection Prevention and Control for over 20 years. Her knowledge, professionalism, hard work and dedication to nursing and infection prevention and control has been a great asset to her fellow companions. Marion has not only been able to provide an abundance of professional knowledge and advice but she has been repeatedly able to make her fellow workers feel important and provide a role that others would want to follow in. Her constant reassurance and support to others have helped her fellow Infection Control Practitioners (ICPs) accomplish and achieve many goals.

She has served her colleagues in many professional positions, both provincial and national. She has undertaken the role of president of her chapter and in 2007 and 2008 Marion very ably took on the responsibilities of president-elect and then president of IPAC Canada. She is an educator, having delivered presentations in many forums and has chaired both provincial and national conferences. She has taken a lead role in provincial working groups for guidelines, works nationally on different task forces and committees, and has also taken a lead role in SARS, Pandemic and Ebola working groups.

Marion was the first appointed Provincial Infectious Disease Nurse Specialist; part of that role was to work collaboratively with the IPAC Newfoundland Labrador group in leading the province with guidelines on dealing with infectious diseases. She has been a mentor to many, giving guidance and sharing her wealth of knowledge to novice as well as senior ICPs in the province and nationally. Her pleasant voice has answered many calls and provided unlimited guidance even when she has not been working. As a mentor and a friend, Marion is inspirational, caring, supportive, and devoted to her profession.

“Her knowledge, professionalism, hard work and dedication to nursing and infection prevention and control has been a great asset to her fellow companions.”

Marion holds education as a top priority; she has worked hard and continuously advanced her education. Her accomplishments include obtaining her Registered Nurse Diploma, Baccalaureate in Nursing Degree and her Masters in Nursing. She has been an avid promoter of the Certification in Infection Prevention and Control and has continued to maintain her certification throughout the years. Marion is very passionate and enthusiastic about infection prevention and control, including a priority of safety for staff, patients, and the community at large.



Marion is well respected by IPAC NL, her provincial colleagues as well as across the country. She recently was awarded the Provincial Public Service Award in Newfoundland Labrador, which is the highest public servant achievement award in the province.

Honorary Membership will be officially bestowed at the Opening Ceremonies of the 2016 annual education conference (Sunday, May 15; Niagara Falls). \*

If you think doing more for patient safety is unaffordable, how does **FREE\*** sound?

HPS has partnered with SaniPULL to bring practical and affordable hygienic solutions to your facility!

SaniPULL is a cleanable and ergonomic ribbon-profile retrofit pull system for over bed lights and nurse call fixtures, that provides patient risk mitigation and delivers cost avoidance benefits.

HPS is an environmental hygiene solutions team. Ask us about our facility assessment and product installation services.

Tel: 905.361.8749  
Email: info@hygieneperformancesolutions.com  
www.hygieneperformancesolutions.com

**SANI PULL** **Hygiene**  
performance solutions

\*Standard installation in Western Canada & Central. The cost of which varies depending on site by related cost avoidance opportunities.

# CIC® Graduates

New and certified CIC®s from a variety of healthcare settings have spent hours studying, digesting facts, and reading current literature. This information and life experience, along with a successful completion of the CIC® examination, ensure infection prevention and control professionals deserve to place a CIC® after their names. Congratulations to the following October-December 2015 graduates.

## First-time Certifiers

Vishnuka Arulsundaram, RN, CIC, Toronto, ON  
Sherry L. Engel, CIC, Saskatoon, SK  
Khalid Haji-Kusow, CIC, Toronto, ON  
Taghi Naserpour Farivar, BSc., MSc., PhD., CIC, Burnaby, BC  
Will Ng, BSc(Hon), MHSc, CIC, Toronto, ON  
Chantal M. Porter, BScN, CIC, Timmins, ON  
Tristan S.C. Squire-Smith, RN, MBA, CHE, CIC, London, ON  
AnnMarie Tyson, CIC, Toronto, ON

## Recertified

Nalini Agnihotri, CIC, Oakville, ON  
Kimberley Allain, BScN, RN, MHS, CIC, Halifax, NS  
A. Naideen Bailey, CIC, Toronto, ON  
Stefania C. Cloutier, CIPHI(C), ICP, CIC, Toronto, ON  
Laurie J. Conway, CIC, Toronto, ON  
Melody C. Cordoviz, CIC, Edmonton, AB  
Alisa P. Cuff, RN, CIC, Lewisporte, NL  
Simona M. Dalgleish, CIC, Hamilton, ON  
Katherine E. Defalco, RN, CIC, Ottawa, ON  
Kristine G. Desjardine, MN, BScN, CIC, Ottawa, ON

Joanne M. Dow, RN, CIC, London, ON  
Sandra M. Dunnett, RN, CIC, St. Catharines, ON  
Rohit Garg, MBBS, MPH, CIC, Toronto, ON  
James A. Gauthier, MLT, CIC, Oakville, ON  
Diana Gowanlock, CIC, Thunder Bay, ON  
Isabelle Guerreiro, CIC, Toronto, ON  
Frances L. Hanna, CIC, Edmonton, AB  
Debra Hayden, CIC, Toronto, ON  
Fatema Jinnah, CIC, Toronto, ON  
Jessica Kooger, BSc., CIC, Woodstock, ON  
Kathy L. Maxwell, RN, CIC, Toronto, ON  
Maja McGuire, CIC, Toronto, ON  
Lesley McLeod, MSc, CIC, Regina, SK  
Evelyn Myles, RN, BScN, CIC, Edmonton, AB  
Sandina M. Noble, RN, BSc, CIC, Toronto, ON  
Marilyn J. Petherick, CIC, Campbellford, ON  
Corrinne L. Pidhorney, CIC, Calgary, AB  
Gordana Pikula, CIC, Toronto, ON  
Katherine Pollard, RN, CIC, Waterloo, ON  
Carly Rebelo, MSc, CIC, Toronto, ON  
Anne M. Rozalowsky, RN, BScN, CIC, Utterson, ON  
Lorraine Marie Schatzler, CIC, Sudbury, ON  
Slobodanka Varda, CIC, Scarborough, ON  
Sumana Vinod, MBBS, MPH, CIC, Toronto, ON  
Heidi N. Willekes, RN, BScN, CIC, Brantford, ON  
Victoria L. Willet, RN, CIC, Sault Ste. Marie, ON  
Victoria R. Williams, CIC, Toronto, ON  
Rebecca S.Y. Yu-Liu, OHN, CIC, Whitby, ON 🍁

## VACCINATION: YOUR BEST SHOT

LEARN MORE. TALK TO YOUR DOCTOR, NURSE, PHARMACIST OR LOCAL PUBLIC HEALTH OFFICE TODAY, OR VISIT: [IMMUNIZE.CA](http://IMMUNIZE.CA)

 Public Health Agency of Canada  Agence de la santé publique du Canada



is more than just talk

As we continue to deliver valuable information through the pages of this magazine, in a printed format that is appealing, reader-friendly and not lost in the proliferation of electronic messages that are bombarding our senses, we are also well aware of the need to be respectful of our environment. That is why we are committed to publishing the magazine in the most environmentally-friendly process possible. Here is what we mean:

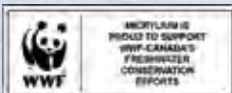
- We use lighter publication stock that consists of recycled paper. This paper has been certified to meet the environmental and social standards of the Forest Stewardship Council® (FSC®) and comes from responsibly managed forests, and verified recycled sources making this a RENEWABLE and SUSTAINABLE resource.
- Our computer-to-plate technology reduces the amount of chemistry required to create plates for the printing process. The resulting chemistry is neutralized to the extent that it can be safely discharged to the drain.
- We use vegetable oil-based inks to print the magazine. This means that we are not using resource-depleting petroleum-based ink products and that the subsequent recycling of the paper in this magazine is much more environment friendly.
- During the printing process, we use a solvent recycling system that separates the water from the recovered solvents and leaves only about 5% residue. This results in reduced solvent usage, handling and hazardous hauling.
- We ensure that an efficient recycling program is used for all printing plates and all waste paper.
- Within the pages of each issue, we actively encourage our readers to REUSE and RECYCLE.
- In order to reduce our carbon footprint on the planet, we utilize a carbon offset program in conjunction with any air travel we undertake related to our publishing responsibilities for the magazine.

So enjoy this magazine...and KEEP THINKING GREEN.

# BioTEXT™

## UNIVERSAL SURFACE DISINFECTANT

“Boldly works where  
no others dare”



Micrylium is proud to support WWF-Canada's freshwater conservation efforts. Visit [www.wwf.ca](http://www.wwf.ca) © 1986 Panda symbol WWF-World Wide Fund For Nature (also known as World Wildlife Fund) \*\*WWF is a WWF Registered Trademark



MICRYLIUM IS  
PROUD TO SUPPORT

DOCTORS WITHOUT  
BORDERS  
MEDECINS SANS  
FRONTIERES

1.800.489.8868

[www.micrylium.com](http://www.micrylium.com)

 **Micrylium**  
PROFESSIONAL DISINFECTION

This journal would not be possible without the advertising support of the following companies and organizations. Please think of them when you require a product or service. You can also access the electronic version at [www.ipac-canada.org](http://www.ipac-canada.org).



Company	Page	Phone	Web Site
3M	64	800-364-3577	<a href="http://www.3m.ca/wipechallenge">www.3m.ca/wipechallenge</a>
AMG Medical Inc.	IBC	800-363-2381	<a href="http://www.nocospray.ca">www.nocospray.ca</a>
Baxter Corporation	60	800-387-8399	<a href="http://www.baxter.ca">www.baxter.ca</a>
CHAIR (Coalition for Healthcare Acquired Infection Reduction)	63		<a href="http://www.chaircanada.org">www.chaircanada.org</a>
Class 1 Inc.	40	800-242-9723	<a href="http://www.class1inc.com">www.class1inc.com</a>
Clorox Healthcare	1-3	866-789-4973	<a href="http://www.cloroxhealthcare.ca">www.cloroxhealthcare.ca</a>
CSA Group	57	877-223-8480	<a href="http://www.Shop.csa.ca">www.Shop.csa.ca</a>
DebMed	41	888-332-7627	<a href="http://www.debmed.com">www.debmed.com</a>
Emerald Health Information Systems	45	613-599-8178	<a href="http://www.emeraldhis.com">www.emeraldhis.com</a>
GOJO Canada, Inc.	48, insert	800-321-9647	<a href="http://www.GOJOCanada.ca">www.GOJOCanada.ca</a>
Hygie	8	866-588-2221	<a href="http://www.hygie.com">www.hygie.com</a>
Hygiene Performance Solutions	44, 65	905-361-8749	<a href="http://www.hygienep performancesolutions.com">www.hygienep performancesolutions.com</a>
Imperial Surgical Ltd.	50	800-661-5432	<a href="http://www.surgmed.com">www.surgmed.com</a>
Medco Equipment	39	800-717-3626	<a href="http://www.medcoequipment.com">www.medcoequipment.com</a>
Metrex Corp.	7	800-841-1428	<a href="http://www.metrex.com">www.metrex.com</a>
Micrylium Professional Disinfection	67	800-489-8868	<a href="http://www.micrylium.com">www.micrylium.com</a>
PDI - Professional Disposables International, Inc.	OBC	800-263-7067	<a href="http://www.pdihc.com">www.pdihc.com</a>
Pinchin LTD.	60	855-PINCHIN	<a href="http://www.pinchin.com">www.pinchin.com</a>
Primed Canada, Inc.	62	800-267-0844	<a href="http://www.primedcanada.com">www.primedcanada.com</a>
Process Cleaning Solutions	61	877-745-7277	<a href="http://www.processcleaningsolutions.com">www.processcleaningsolutions.com</a>
Retractable Technologies, Inc.	4	888-703-1010	<a href="http://www.vanishpoint.com">www.vanishpoint.com</a>
Rubbermaid Commercial Products	54	800-998-7004	<a href="http://www.rubbermaidhygen.com">www.rubbermaidhygen.com</a>
Sage Products LLC	58	800-323-2220	<a href="http://www.sageproducts.com">www.sageproducts.com</a>
SciCan Ltd.	42	800-667-7733	<a href="http://www.scican.com">www.scican.com</a>
Sealed Air Diversey Care	6, 37	800-558-2332	<a href="http://www.sealedair.com">www.sealedair.com</a>
STERIS Canada Inc.	56	800-661-3937	<a href="http://www.steris.com">www.steris.com</a>
The Stevens Company Limited	63	800-268-0184	<a href="http://www.stevens.ca">www.stevens.ca</a>
Vernacare Canada Inc.	10, insert	800-268-2422	<a href="http://www.vernacare.com">www.vernacare.com</a>
Virox Technologies Inc.	IFC	800-387-7578	<a href="http://www.virox.com">www.virox.com</a>
Xenex Disinfection Services	38	888-764-2964	<a href="http://www.xenex.com">www.xenex.com</a>

To reach infection control professionals across Canada through the **Canadian Journal of Infection Control** and its targeted readership, please contact me at

**Al Whalen, Marketing Manager 1-866-985-9782 [awhalen@kelman.ca](mailto:awhalen@kelman.ca)**





IMAGINE IF DISINFECTING  
AN ENTIRE ROOM  
WAS **JUST THIS EASY.**



Introducing the  
**nocospray system**  
enhanced disinfection: simplified

Imagine disinfecting a room with just the push of a button. Now imagine achieving a 99.9999% reduction in a room that previously housed *C.difficile*. Nocospray can do both.

Developed in Europe and now available in Canada, the Nocospray System, when used in conjunction with mechanical cleaning, empowers you to enhance your disinfection at the push of a button.



Visit us on the web:

**[www.nocospray.ca](http://www.nocospray.ca)**

or call us at **1.800.363.2381**

Innovation from:



# Your Partner In Infection Prevention

PDI's infection prevention solutions target skin antisepsis, environmental hygiene, hand hygiene and patient care to help get patients back home to their families where they belong.



Contact your Territory Sales Manager for more information.

PDI Sani-Cloth® Plus Large Canister (DIN 02242608); PDI Sani-Cloth® Plus X-Large Canister (DIN 02242608)  
PDI Chlorascrub® Prep Pads (DIN 02243003); PDI Chlorascrub® Swabstick 1's (DIN 02243002).  
PDI®, Chlorascrub®, Sani-Cloth®, and Hygea® are registered trademarks of Professional Disposables International, Inc. Be The Difference™ is a trademark of Professional Disposables International, Inc. ©2016 Professional Disposables International, Inc. All rights reserved. PDI03168437  
PDI | 140 Woodbridge Avenue | UN CL-1 | Market Lane Plaza | Vaughan ON L4L4K9 | 905-856-4361 | 800-263-7067 | pdihc.com

