VOLUME 34
NUMBER 4

WINTER 2019

CJIC

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

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

INSIDE

PM# 40065075 Return undeliverable Canadian addresses to lauren@kelman.ca

“Houston, we have a pathogen.”

Accelerated Hydrogen Peroxide®/AHP® is not only killing pathogens in healthcare facilities around the world, but is now also being used in outer space. Learn more at our booth. Who knows where AHP® will go next?

ACCELERATED® HYDROGEN PEROXIDE® Patented | **virox.com**

Contain Infection

With Vernacare's Environmentally Friendly Human Waste Disposal Systems

Vernacare's complete system remains the world leader in delivering environmentally responsible, energy efficient and safe solutions for human waste management.

Vernacare has been revolutionizing the management of hospital human waste with the world's leading single-use system for over 50 years.

Benefits of the Award-Winning Vernacare System:

- Environmentally friendly fibre utensils made from 100% recycled newsprint fused together with a natural wax
- Reliable ISO 14001 certified manufacturing with a quality support network
- Biodegradable products for safe and convenient disposal
- Maceratable patient wipes and a full line of accessories
- **SmartFlow**™ technology uses less water and energy
- Industry leading macerator systems backed by a team of highly trained technical support specialists

Lowering the Environmental Impact

Vernacare's single-use system uses less energy and water than reusable systems and our biodegradable products are made from 100% recycled newsprint.

For more information:
1-800-268-2422 • www.vernacare.com

Vernacare

Plan to prevent.

Process compliance for optimal protection against healthcare-associated infections.

Maintaining a safe, clean and hygienic environment, and minimizing microbial contamination of surfaces, items and equipment within the healthcare environment are increasingly recognized as an essential approach to reducing the risk of healthcare-associated infections.[1,2]

Pathogens can spread easily in high-traffic facilities. Cleaning and disinfection of equipment (medical, clinical) are important components of preventing the spread of microorganisms that can cause infections; however, such equipment is often composed of many different materials, each of which may respond differently to disinfectants used in healthcare and fitness facilities.[3]

Pathogens such as *Clostridium difficile*, vancomycin-resistant enterococci (VRE) or methicillin-resistant *Staphylococcus aureus* (MRSA) can persist on surfaces and items for prolonged periods of time, sometimes up to several months.[4]

Healthcare providers who come in contact with surfaces in the room of a patient colonized with MRSA or VRE have a 42% to 52% risk of subsequent hand or glove contamination with the same organism; this risk is similar to the risk seen following direct contact with the patient.[5,6] After contact with a VRE-contaminated surface, healthcare providers transmit VRE to the next clean surface or skin site they come in contact with approximately 10% of the time.[7]

Studies show that up to 85% of wheelchairs in hospitals are contaminated with pathogens such as MRSA.[8]

A newly released Canadian report suggests that antibiotic resistance is expected to have a stark impact over the next three decades, with superbugs estimated to lead to 400,000 deaths, resulting in $120 billion in hospital costs by 2050.[9]

Know your high-risk surfaces.

High-touch surfaces and items require more frequent cleaning and disinfection than low-touch surfaces and items, for example, patient beds and surrounding equipment, light switches, blood pressure and ECG carts, nursing stations, call bells, door handles, washrooms, etc.[11]

Additionally, to prevent the transfer of pathogens from the previous room occupant to a new patient, the room or bed space must be cleaned and disinfected thoroughly.[11]

Only about 50% of surfaces in hospital operating or patient rooms are effectively disinfected.[12]

Optimize your disinfection strategy.

The cornerstone of efforts to reduce the risk of transmission of microorganisms from the environment is the cleaning and disinfection of all surfaces, items and equipment in the healthcare setting on a regular and systematic basis.[10]

In its recent report, *Best Practices for Environmental Cleaning for Prevention and Control of Infections in All Health Care Settings*, the Provincial Infectious Diseases Advisory Committee (PIDAC) suggests the following should be considerations when deciding upon an effective cleaning and disinfection strategy:[11]

- Frequency of cleaning
- Cleaning method
- Types of cleaning solutions
- Kill claims
- Contact and drying times of cleaning solutions
- Surface compatibility
- Alcohol-free
- Odour
- Ease of use and aesthetics
- Cost and environmental impact

CloroxPro™ can help.

Clorox Professional is continually developing advanced and comprehensive solutions that help eliminate healthcare-associated infections wherever they are.

1. Dancer SJ. *Eur J Clin Microbiol Infect Dis* 2011;30(12):1473-81. **2.** Weber DJ, Rutala WA. *Infect Control Hosp Epidemiol* 2013;34(5):449-52. **3.** Lankford MG, *et al.* Limiting the spread of infection in the health care environment. Assessment of materials commonly utilized in healthcare: Implications for bacterial survival and transmission. Concord, CA: Coalition for Health Environments Research (CHER) and The Center for Health Design; 2007. http://www.healthdesign.org/sites/default/files/limiting_the_spread_of_infection.pdf. Accessed November 20, 2019. **4.** Kramer A, *et al. BMC Infect Dis* 2006;6:130. **5.** Hayden MK, *et al. Infect Control Hosp Epidemiol* 2008;29(2):149-54. **6.** Boyce JM, *et al. Infect Control Hosp Epidemiol* 1997;18(9):622-7. **7.** Duckro AN, *et al. Arch Intern Med* 2005;165(3):302-7. **8.** Hakuno H, *et al. J Hosp Admin* 2013;2(2):55-60. **9.** Council of Canadian Academies, 2019. When antibiotics fail. Ottawa (ON): The Expert Panel on the Potential Socio-Economic Impacts of Antimicrobial Resistance in Canada, Council of Canadian Academies. **10.** Donskey CJ. *Am J Infect Control* 2013;41(5 Suppl):S12-9. **11.** Ontario Agency for Health Protection and Promotion (Public Health Ontario), Provincial Infectious Diseases Advisory Committee. Best practices for environmental cleaning for prevention and control of infections in all health care settings, 3rd edition. Toronto, ON: Queen's Printer for Ontario; 2018. **12.** Bhalla A, *et al. Infect Control Hosp Epidemiol* 2004;25(2):164-7.

CLOROXPRO™

For more information, or to try CloroxPro™ products at your facility, visit:
CloroxHealthcare.ca | healthcare@clorox.com

Protect her.
She has a spelling bee tomorrow.

CloroxPro™ offers 3 chemistries for triple protection from hospital-acquired infections.

Your patients trust you to create a clean healing environment, so trust CloroxPro™ to stand behind you to help protect them. With multiple Health Canada registered disinfectants, based on 3 chemistries in a variety of ready-to-use formats, you have more choices to meet your unique cleaning and disinfection needs. Because we believe that supporting you every step of the way means protecting them.

CLOROXPRO™

CloroxHealthcare.ca | healthcare@clorox.com

EASYPOINT®

retractable needle

AUTOMATED
RETRACTION
NOW WITH ADDED
VERSATILITY

WHEN ACTIVATED,
NEEDLE RETRACTS
AUTOMATICALLY

Now available in ***NEW*** *sizes*

RETRACTABLE NEEDLES
(50 per box/400 per case)

Needle Size	Catalog #
25G x 5/8"	82091
25G x 1"	82011
25G x 1 1/2"	85011
23G x 1"	82031
22G x 1 1/2"	85031
21G x 1 1/2"	85051
18G x 1"	85081
18G x 1 1/2"	85091

RETRACTABLE TECHNOLOGIES, INC.
www.retractable.com

511 LOBO LANE, LITTLE ELM, TX 75068-5295 • *PHONE* 972-294-1770 • *TOLL FREE* 1-888-703-1010 • *FAX* 972-294-4400 • *RTISERVICE@VANISHPOINT.COM*

3M Science. Applied to Life.™

Put confidence in your hands.

Your partner in sterilization monitoring solutions

Steam sterilization monitoring, **now optimized.**

Your process just got a whole lot simpler and faster. Improve your efficiency of processing Biological Indicators (BIs) with 3M's latest innovation, so you can do more in less time.

With the new 4.2.7 software for the 3M™ Attest™ Auto-reader 490 Biological Indicator System get your results in only 24 minutes.

3M Medical Solutions Division | 3M Canada
300 Tartan Drive, London, ON N5V 4M9
1 800 364-3577 | www.3M.ca

hygie®
Together, let's protect life!

'Tis the season... to prevent flu outbreaks...

Prepared by Silvana Perna, M.Sc.(A), CIC, CNS-IPC

The holiday season is just around the corner. While everyone is busy decorating, shopping and attending social gatherings, there's another type of festivity taking place. This is the time of year when respiratory viruses have their own blast and the leading socialite among them is the influenza virus. The influenza virus has been around for hundreds of years and makes its appearance every season during the winter months. Although there are 4 types of seasonal influenza viruses (type A, B, C and D), influenza is caused primarily by the influenza A or B virus. Influenza A viruses are classified into subtypes according to the outer covering of the virus: glycoprotein combinations referred to as the hemagglutinin (HA) and the neuraminidase (NA). The influenza B virus instead is broken down into lineages. According to the World Health Organization the subtypes A(H1N1) and A(H3N2) and the influenza type B viruses belonging to B/Yamagata or B/Victoria lineage are currently circulating.

Influenza symptoms usually appear 1 to 4 days after exposure to the virus and can last up to 10 days. The tricky thing about influenza is that you can be infectious one day before the sudden appearance of symptoms which include headache, chills and cough followed by a fever, loss of appetite, muscle aches, and fatigue. In some cases you may not have any symptoms at all but nonetheless spread influenza to those who are more susceptible such as the very young, the very old and those with weakened immune systems. In this category of patients, influenza can cause very serious complications such as pneumonia or the worsening of underlying health conditions that can lead to hospitalization, antibiotic use, and even death. **Health Canada estimates that influenza causes approximately 12,200 hospitalizations and 3,500 deaths each year, predominantly due to influenza A viruses.**

December is the season to deck the halls but it's also the period in the Northern Hemisphere when influenza activity is on the rise and this represents a risk for influenza outbreaks. Influenza is easily transmitted by the droplets of an infected person through coughing or sneezing. It may also be transmitted through direct or indirect contact with infected respiratory secretions. Due to the short incubation period, the ease of transmission and rapid spread in gathered spaces, the virus can cause seasonal outbreaks in healthcare settings. This is especially true in long term care where due to the nature of interactions in a home-like setting, ample opportunities for the spread of influenza exist. In the FluWatch report, Canada's national influenza surveillance system, 1,038 laboratory-confirmed outbreaks were reported during the 2018-19 influenza season, where slightly over 60% occurred in long-term care and almost entirely were related to influenza A. Outbreaks can have a big impact on a healthcare institution affecting the flow of admissions, increasing costs due to isolation and the increased use of resources, prolonging hospitalization, including ICU transfers and contributing to healthcare provider absenteeism.

When it comes to infection prevention and control measures for influenza, we need to step it up during the holiday season. These measures require a multi-modal approach. The influenza vaccine for healthcare providers and patients is the most effective way to prevent influenza infection or to limit the shedding of virus if one does get ill. Other measures are also necessary. Health Canada recommends the following core strategies for preventing influenza infection: staff education, staff access to adequate hand hygiene products and sufficient personal protective equipment, appropriate management of symptomatic healthcare providers, implementation of respiratory hygiene and cough etiquette, use of spacial separation and droplet and contact precautions for managing symptomatic patients, reinforcement of hand hygiene, and application of appropriate environmental measures. Finally, clear administrative policies and procedures on preventing influenza exposures throughout the duration of a patient's visit to the healthcare setting should be available to all staff and adhered to.

This holiday season, share the joy with those around you and give the gift of a safe holiday by taking action to prevent the spread of influenza.

Silvana Perna is a an infection prevention and control specialist who provides consulting services for Hygie. Hygie is a for-profit company that manufactures products for body fluid management in healthcare settings. No specific products are endorsed in this article.

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.

Medco EQUIPMENT

For more information call (800) 717-3626 or visit
www.medcoequipment.com

EDITOR
Victoria Williams, BSc, BASc, MPH, CIC
Infection Prevention and Control Coordinator
Sunnybrook Health Sciences Centre
2075 Bayview Ave., Toronto, ON M4N 3M5
Tel: 416-480-6100 x 7970 Fax: 416-480-6845
editor-in-chief@ipac-canada.org

ASSOCIATE EDITOR
Devon Metcalf, MSc, PhD, CIC
Infection Prevention and Control Specialist
Public Health Ontario
350 Conestoga Blvd., Unit B4B, Cambridge, ON N1R 7L7
Tel: 226-314-2127 Fax: 519-624-6212
associate-editor@ipac-canada.org

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

PUBLISHER
Craig Kelman & Associates

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 - Reba R. Lewis
DESIGN/PRODUCTION - Dani Goulet
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
No preventable infections for Canadians. Ever.

MISSION
We inspire, nurture and advance a culture committed to infection prevention and control.

IPAC CANADA is now on YOUTUBE, FACEBOOK, TWITTER and LINKED IN

WINTER 2019

VOLUME 34
NUMBER 4

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

FEATURES

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: 3,000.

Advertising or products and services in the *Canadian Journal of Infection Control* do not imply endorsement by IPAC Canada.

ISSN 1183-5702

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

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

IPAC CANADA
2019 - 2020 Board of Directors

Executive Officers

President
Barbara Catt, RN, BScN, MEd, CIC
Manager IPAC Response and Support
Public Health Ontario
480 University Ave, Ste. 300
Toronto, ON M5G 1V2

President-elect
Zahir Hirji, BScN, MHS, CIC,
Manager, Risk Management/Patient Safety
Scarborough and Rouge Hospital
2867 Ellesmere Road
Scarborough, ON M1E 4B9

Past President
Molly Blake, BN, MHS, GNC(C), CIC
Infection Control Professional
Winnipeg Regional Health Authority
232A North Pavilion, 2109 Portage Avenue
Winnipeg, MB R3J 0L3

Secretary
Jennifer Happe, BSc, MSc
Infection Control Professional
Alberta Health Services
3942 50 A Avenue, Red Deer, AB T4N 6R2

Treasurer
Michael Rotstein, RN, BScN, MHSc, CIC, CHE
Client Services Director
Closing the Gap Healthcare
2810 Matheson Blvd E, Ste 100
Mississauga ON L4W 4X7

Directors

Kim Allain, BScN, RN, MHS, CIC
Quality Improvement and IPAC Safety Lead
Nova Scotia Health Authority
902 Bethune Bldg, 1276 South Park Street
Halifax, NS B3H 2Y9

Madeleine Ashcroft, RN, BScN, MHS, CIC
Infection Control Specialist
Public Health Ontario
300-480 University Avenue
Toronto, ON M5G 1V2

Joseph Kim, MD, FRCPC
Infectious Disease Consultant
Alberta Health Services
7007 14 Street SW
Calgary, AB T2V 1P9

Ramona Rodrigues, RN, BSc, MSc(A), CIC, ICS-PCI, FAPIC
McGill University Health Centre
Montréal General Hospital
1650 Cedar Avenue
Montréal, QC H3G 1A4

Baljinder Sidhu, RN, BScN, CIC, MPH
IP Specialist, Sterile Processing Practices/
Auditing Provincial
Health Services Authority of BC
4500 Oak Street
Vancouver, BC V6N 3N1

Public Representative
Stephen Palmer
79 Amberview Drive
Keswick, ON L4P 3Y3

Other Positions

Editor-in-Chief – Canadian Journal of Infection Control
Victoria Williams, BSc, BASc, MPH, CIC
Infection Prevention and Control
Epidemiologist/Coordinator
Sunnybrook Health Sciences Centre
2075 Bayview Avenue, Toronto, ON M4N 3M5

Associate Editor
Devon Metcalf, MSc, PhD, CIC
Infection Prevention and Control Specialist
Public Health Ontario
350 Conestoga Blvd., Unit B4B,
Cambridge, ON N1R 7L7

Web Communications Manager
Tanya Denich, MSc, CIC

Webmaster
Pamela Chalmers

Online Novice IP&C Course Coordinators
Heather Candon, BSc, MSc, CIC
Jane Van Toen, MLT, BSc, CIC

Social Media Manager
Kelsey Houston BScH MPH

Professional Agents

Legal Counsel
Terrance Carter/Theresa Man
Carters Professional Corporation
211 Broadway, Orangeville, ON L9W 1K4

Auditor
Philip Romaniuk, CPA, CA
Grant Thornton LLP
94 Commerce Drive
Winnipeg, MB R3P 0Z3

Membership Services Office

Executive Director
Gerry Hansen, BA
PO Box 46125 RPO Westdale,
Winnipeg, MB R3R 3S3
Phone: 204-897-5990/866-999-7111
Fax: 204-895-9595
executivedirector@ipac-canada.org

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

Administrative Assistant
Kelli Wagner
Phone: 204-488-5027 Fax: 204-488-5028
Toll-Free: 1-855-488-5027
admin@ipac-canada.org

Conference Coordinator
Pascale Daigneault
Phone: 780-436-0983 ext. 223
Fax: 780-437-5984
pascale@buksa.com

General Information
info@ipac-canada.org

Return to TABLE OF CONTENTS

Why infection prevention and control professionals should strive to publish

Devon Metcalf MSc, PhD, CIC, Associate Editor
Victoria Williams MPH, CIC, Editor-in-Chief

For the infection prevention and control professional (ICP), the importance of sharing our work, whether it be original research findings, quality improvement initiatives, or experiences with outbreaks, cannot be overstated. While we may engage in research to inform practice within our own organizations, ICPs should strive for broader dissemination achievable through presentations at conferences and publications in peer-reviewed scientific journals. In the absence of such shared experience, ICPs risk working in isolation and struggling with similar challenges when a common solution may exist. Broad dissemination of research can break down silos and spark important conversations among ICPs as well as with our colleagues working in complimentary disciplines such as public health, epidemiology, nursing, microbiology and infectious diseases. It gives ICPs the opportunity to make a contribution to the field and influence practice. The development of evidence-based guidance for decision-making and to inform policies and programs is critically important to the field of infection prevention and control (IPAC), and is dependent on the dissemination of research findings.

In the IPAC Canada 2018 Mega Survey, only 29% of respondents reported having submitted their work for publication in a scientific journal [1]. Barriers to publishing our work may include a lack of time, resources and support from our organizations, inexperience in research and writing, and perhaps limited confidence in our abilities and the suitability of our work for publication. Despite these challenges, ICPs should strive to develop the skills to propose, conduct, analyze and describe their own research to help answer IPAC questions and to advance the knowledge base of the field. For those with less experience in preparing their work for presentation and publication, IPAC Canada has resources available to support the process. The 2019 IPAC Canada and International Federation of Infection Control Conjoint Conference featured a presentation by Kathryn Suh entitled Manuscript Preparation: How to Get Your Paper Published [2]. With the slide deck available on the IPAC Canada website, anyone considering publishing their work can refer to the slides for consideration about the importance of publishing, how to structure a manuscript and practices to avoid. An IPAC Canada webinar entitled Tricks and Tips for Abstract Writing presented by Gwyneth Meyers is also available on the IPAC Canada website [3]. This webinar can support ICPs by providing guidance for writing a compelling abstract for multiple purposes including conference presentations, grant proposals and as part of a manuscript for publication.

Other strategies to address the barriers that ICPs face could include collaborating with or seeking mentorship from a more experienced colleague who may have previously navigated the publication process. Alternatively, experienced researchers could seek out mentorship opportunities to support novice researchers in designing, conducting and writing up their research projects. Starting small, with a simple research project, provides the opportunity to develop the skills needed for more complicated projects. Also, it is important to remember that not all work worthy of publication adheres to the format of formal, original research. There is great value in sharing the lessons learned from an outbreak investigation or a description of a quality improvement initiative. Refer to the Guidelines for Authors for a description of all publication categories accepted by CJIC.

Those in leadership positions should encourage and support ICPs in their publication endeavours to promote staff engagement, and as a means of professional development through the extension of professional knowledge and skills development. Involvement in research activities is recognized by various professional organizations as an important component of the role of an ICP. The IPAC Canada Core Competencies for Infection Control Professionals (2016) describes the required knowledge, skills and attitudes of a competent ICP [4]. The ability to develop research proposals, collect and analyze data and disseminate research findings are classified as foundational core competencies. The Association for Professionals in Infection Control and Epidemiology (APIC) also lists conducting and participating in routine investigational and epidemiological research as a professional and practice standard [5]. Starting in 2020, the Certification Board of Infection Control and Epidemiology, Inc. (CBIC) is offering a new option for recertification. In addition to the current examination option, ICPs will be able to recertify by continuing education. Referred to by CBIC as infection prevention units (IPUs), continuing education includes 'Publications' as a category and authors of IPAC-related, peer-reviewed journal articles will receive five IPUs per publication (towards the 40 IPUs minimum required to recertify) [6]. The recognition of the importance of publications in professional development

by these organizations further highlights the dual benefit to both the ICP and to the broader field of IPAC.

ICPs should evaluate the work we do and the changes we would like to implement to identify what could benefit other ICPs if disseminated broadly. Considering the heavy workload and resource limitation ICPs often face, prioritization of research activities can be a significant obstacle. Engaging leadership with a clear message about the benefits of researching and publishing within our organizations could potentially garner the support and resources necessary for the fundamental work of sharing evidence. If ICPs do not prioritize contributions to our own field and the ongoing maintenance of high-quality IPAC practice, who will?

REFERENCES

1. Catt, B., Williams, V., Hansen, G. (2018). IPAC Canada 2018 Mega Survey Results. IPAC Canada Association News. Retrieved from https://ipac-canada.org/photos/custom/Members/E-news/IPAC_News_Fall2018_FINAL_ver2.pdf
2. Suh, K. (2019). Manuscript Preparation: How to Get Your Paper Published. 28 May 2019. IFIC IPAC 2019 Conjoint Conference, Quebec City, Quebec. Retrieved from https://ipac-canada.org/photos/custom/conf/19conf/orals19/tues_Suh.pdf
3. Meyers, G. (2019). Tricks and Tips for Abstract Writing. Retrieved from https://ipac-canada.org/webinar-tricks-and-tips-for-abstract-writing.php
4. Moralejo, D., Catt, B., Ashcroft, M., Christou, H., DeFalco, K., Dyck, B., Rhodenizer-Rose, S. (2016). IPAC Canada Core Competencies for Infection Control Professionals. Retrieved from https://ipac-canada.org/photos/custom/Members/pdf/2016_IPAC_Canada_CoreCompetenciesforICPs.pdf
5. Bubb, T., Billings, C., Berriel-Cass, D., Bridges, W., Caffery, L., Cox, J., Rodriguez M, Swanson, J., Titus-Hinson, M. (2016). APIC professional and practice standards. American Journal of Infection Control. Retrieved from https://apic.org/Resource_/TinyMceFileManager/PDC/PPS.pdf
6. Certification Board of Infection Control and Epidemiology, Inc. (2019). Infection Prevention Units. Retrieved from https://www.cbic.org/CBIC/PDFs/CBIC_InfectionPreventionUnitsIPUs.pdf

POSITION STATEMENT: VRE screening and contact precautions

This position statement was developed by the Standards and Guidelines Committee.
Chair: Madeleine Ashcroft
Principal Authors: Standards and Guidelines Committee

Publication Date
Original: 2012 November
Revised: 2019 November

BACKGROUND

Vancomycin resistant enterococci (VRE) are present in many healthcare facilities across Canada to varying degrees, usually as rectal colonization [1]. VRE bacteraemia is associated with greater hospital mortality and length of stay than vancomycin-sensitive enterococcal (VSE) bacteraemia [2]. In recent years, some Canadian healthcare facilities have decided to reduce or stop screening as well as the use of contact precautions as a VRE control strategy. Others continue to support current guideline recommendations for VRE surveillance and the use of additional precautions [3].

POSITION STATEMENT

IPAC Canada recognizes that while there are various bodies of expert opinion on VRE control, recent Ontario studies [3-7] support ongoing screening and contact precautions. Decisions regarding screening and contact precautions should be based on local epidemiology, and guided by regional and provincial recommendations and requirements [4-9]. Further, any changes to practice should be implemented to improve patient care and not be used as a cost-cutting measure. These changes should only be considered in the context of an infection prevention and control program already meeting or exceeding best practices (including hand hygiene, environmental cleaning, routine practices and additional precautions).

For those healthcare facilities that are considering or have implemented a reduction in VRE control strategies, IPAC Canada recommends an approach that considers the following:

- Epidemiologic investigation and risk assessment for VRE infections;
- Consultation with staff and client groups, including high-risk wards/clinics;
- Consultation with institutional stakeholders;
- Discussion with other internal and external stakeholders, including the health region; and
- An enhanced communication strategy addressing multiple contingencies (e.g., continued surveillance may show a need to return to previous practices)

Further, IPAC Canada recommends that any savings incurred from decreased screening and contact precautions is reinvested in the following activities (as determined by the risk assessment above):

- Education on Routine Practices
- Environmental cleaning;
- Hand hygiene;
- Antimicrobial stewardship;
- Monitoring of healthcare-acquired infections (HAIs); and
- Other activities deemed important for infection control and prevention.

Decreased surveillance of VRE results in a paucity of information regarding colonization. Any reduction in screening and contact precautions should be accompanied by close monitoring of all VRE culture-positive HAIs to ensure that undue harm is not incurred as a result. In the event that harm is found, institutions should be prepared to return to previous policies. It is also highly recommended that those institutions that choose to change their strategy communicate their experiences to other members of the infection control community for future policy making.

STAKEHOLDERS

Infection Prevention and Control Professionals, healthcare workers, and their clients (the Canadian public).

REFERENCES

1. Ofner-Agostini M, Johnston BL, Simor AE, Embil J, Matlow A, Mulvey M, et al. (2008). Vancomycin-Resistant Enterococci in Canada: Results from the Canadian Nosocomial Infection Surveillance Program, 1999-2005. *Infect Control Hosp Epidemiol, 29*(3), 271-4. doi: 10.1086/528812

2. Prematunge C, MacDougall C, Johnstone J, Adomako K, Lam F, Robertson J, et al. (2016). VRE and VSE bacteremia outcomes in the era of effective VRE therapy: A systematic review and meta-analysis. *Infect Control Hosp Epidemiol, 37*(1),26–35. doi:10.1017/ice.2015.228
3. Buick S, Joffe AM, Taylor G, Conly J. (2015). A consensus development conference model for establishing health policy for surveillance and screening of antimicrobial-resistant organisms. *Clin Infect Dis, 60*(7),1095-101. Doi:10.1093/cid/ciu1168
4. Johnstone J, Policarpio ME, Lam F, Adomako K, Prematunge C, Nadolny E, et al. (2017). Rates of blood cultures positive for vancomycin-resistant Enterococcus in Ontario: a quasi-experimental study. *CMAJ Open, 5*(2),e273-80. doi:10.9778/cmajo.20160121
5. A PHO/IPAC memorandum (Update on rising VRE bacteremia rates in Ontario). 23 June 2017. Retrieved from: http://www.publichealthontario.ca/en/eRepository/VRE_Letter_Research_Update.pdf (accessed 31 Oct 2019).
6. Ontario Agency for Health Protection and Promotion (Public Health Ontario), Provincial Infectious Diseases Advisory Committee. Evidence review and revised recommendations for the control of vancomycin-resistant enterococci in all Ontario health care facilities. Toronto, ON: Queen's Printer for Ontario; 2019. Retrieved from: https://www.publichealthontario.ca/-/media/documents/recommendations-vre.pdf?la=en (accessed 31 Oct 2019).
7. Johnstone J, Chen C, Shing E, Adomako K, Garber G, Sander B. The Economic Burden of Vancomycin-Resistant Enterococcus (VRE) Bacteremia: A Population-Based Matched Cohort Study. Poster presented at: 41st Annual North American Meeting of the Society for Medical Decision Making. 2019 Oct 20-23; Portland, OR.
8. Institut national de santé publique du Québec (INSPQ). Healthcare-associated infections provincial surveillance program: Highlights, discussions and orientations 2014–2015. September 2015. Retrieved from https://www.inspq.qc.ca/pdf/publications/2172_highlights_discussions_orientations.pdf (accessed 31 Oct 2019).
9. Han G. The impact of vancomycin-resistant Enterococci (VRE): Policy and practice changes in BC. Retrieved from https://www.picnet.ca/wp-content/uploads/Impact-of-VRE-changes-in-BC.pdf (accessed 31 Oct 2019).

ORIGINAL ARTICLE

Investigation of an outbreak of group A *Streptococcus* in a Regina retirement residence and personal care home, 2018

Trecker M A, Danielson C, Koutsoulis G, Lloyd K, Benz Tramer C, Diener T, Hennink M

Population and Public Health Services, Saskatchewan Health Authority, Regina, SK.

Corresponding author:
Molly Trecker (molly.trecker@saskhealthauthority.ca)

ABSTRACT

Streptococcus pyogenes (group A *Streptococcus*) is a common bacterium that causes infections ranging from minor illnesses, like strep throat, to life-threatening invasive disease. The elderly are particularly at risk of invasive infection, with this risk compounded by living in communal settings, including long-term care facilities or personal-care homes. Following the identification of five invasive group A streptococcal infections in residents of a Regina retirement residence and personal care home over a period of five months, an outbreak was declared on May 8, 2018. Over the 10 weeks the outbreak lasted, 10 cases were diagnosed, attributable to nine individuals: six residents and three staff. Five of the 10 cases (50%) were invasive, all of which required hospitalization. The predominant *emm* type was 92 – a type not common in Canada. Interventions, including onsite inspections, weekly surveillance, hand hygiene and environmental cleaning improvements, as well as mass screening for carriage of group A *Streptococcus* were carried out in collaboration with the personal-care home. Mitigating outbreak risks in private retirement residences and personal care homes requires that facilities establish robust infection control programs, including hand hygiene and effective environmental cleaning, and work collaboratively with Public Health officials to address outbreaks.

KEYWORDS

Group A *Streptococcus; Streptococcus pyogenes;* iGAS; GAS; personal care home

Group A streptococcal (GAS) infections are caused by a common bacterium, *Streptococcus pyogenes*. Infections are often mild, manifesting as illnesses like strep throat, and typically respond well to treatment. Invasive disease (iGAS) can occur, however, causing life-threatening conditions such as necrotizing fasciitis or streptococcal toxic shock syndrome. The elderly are particularly vulnerable to iGAS infection [1], and have the highest case-fatality rates [2]. A number of medical conditions have also been found to be associated with increased risk of iGAS, including dermatologic conditions (such as bullous pemphigoid), diabetes, heart disease, and cancer – conditions more common among this demographic. Further, the risk of acquiring GAS is compounded by living in crowded settings, such as long-term care facilities (LTCFs) or personal care homes (PCHs) [3], and there is a substantial amount of evidence related to the risks specific to residents of these facilities [4-6].

Although the related burden of disease and number of deaths is lower in developed countries such as Canada, iGAS is a nationally notifiable disease [7]. In Saskatchewan, an average of 87 iGAS cases was reported annually between 2004 and 2017. Cases occurred at the same rate among males and females, and 21% of cases were 65 years of age and over. The most prominent *emm* types[1] were *emm*81, *emm*1, and *emm*41.11. The majority of cases presented as bacteremia, with a very small proportion being necrotizing fasciitis (Saskatchewan Ministry of Health, personal communication).

Located in south-central Saskatchewan, Regina is the capital city, with a population of 214,631 individuals, 13.8% of whom are 65 years of age or older [8]. We report here on an outbreak of GAS, which occurred in a dual private retirement residence and PCH in Regina in the late winter till the spring of 2018. The classifications of LTCFs and PCHs differ from one another in that in Saskatchewan, LTCFs are part of the publicly funded healthcare system, and tend to serve residents with more substantial care needs, while PCHs are privately operated facilities, licensed by the Ministry of Health.

This outbreak occurred in a facility that serves as both a private retirement residence and PCH, housing 199 residents, with 50 staff. The multi-story building includes both independent living suites and a PCH. Services provided by the PCH include

ACKNOWLEDGEMENTS

We would like to acknowledge the collaboration of the facility during this outbreak.

CONFLICTS OF INTEREST

None.

[1] *emm* sequence typing is a system used to characterize the degree of genetic diversity among circulating strains of *S. pyogenes; emm* types are numerical, and, where applicable, the subtype is indicated by a number following the decimal point.

assistance with all activities of daily living, and basic nursing care is provided by Licensed Practical Nurses. Residents, including those that live in the PCH, are able to move about the building via two elevators – one in the south wing and one in the north wing. In February 2018, a new male resident moved into the PCH upon discharge from hospital, where he had been treated for iGAS disease (bacteremia) since December 2017. He would ultimately prove to be the index case of the outbreak.

For the purposes of describing this outbreak, the following case definitions were used. Cases were defined as those with laboratory-confirmed GAS from any site, with or without symptoms. iGAS was defined as isolation of GAS (*S. pyogenes*) from a normally sterile site, such as blood [9]. Persistently positive cases were those who remained positive for GAS despite appropriate antibiotic therapy. A case was considered to be a repeat infection when an individual was treated for GAS, confirmed to be negative for GAS from all sites post-treatment, and subsequently developed another symptomatic infection with GAS isolation.

On February 2, 2018, the index case of the outbreak was discharged from hospital, where he had been treated for iGAS (blood). He moved into the North wing of the PCH located on the 2nd floor. On March 9, a second case of iGAS (blood) was identified in a resident on a different floor. A third case (blood) followed two days later, on March 11, in a resident living in the same PCH as the index case. At this time, a four-week period of surveillance for GAS was initiated. No new cases were identified among residents and staff during the four-week period, and surveillance was ended on April 10. Between May 3 and 8, however, two new iGAS (blood) cases were identified among residents of the building, including one living in the PCH. At the same time, the index case was re-hospitalized for a cutaneous GAS infection. In light of these new cases, an outbreak was declared on May 8.

All invasive GAS isolates are submitted to the National Microbiology Laboratory for typing and results are available within approximately one month. *emm* typing from the index case identified in December 2017, and the two cases identified in March 2018, revealed the same type (*emm*92), suggesting they could potentially represent the same strain. Unfortunately, however, this cannot be confirmed because strain typing information was unavailable. Screening of staff and residents was carried out to identify any new cases. In total, all 50 staff, and 25 residents living in the north wing PCH, were swabbed (nose, throat, and any open wounds). Three staff members were found to have asymptomatic carriage of GAS in their throats, and one resident had a GAS-positive wound. The three staff were started on Cephalexin 500mg QID for 10 days by their family physicians, per the Guidelines for the Prevention and Control of Invasive Group A Streptococcal Disease [9], and excluded from work until 48 hours after starting the antibiotics. The resident with the positive wound swab was also treated with antibiotics, and was maintained on contact and droplet precautions for 48 hours after treatment initiation. Each case found during mass screening and/or surveillance was rescreened at 14 and 28 days after treatment began.

The initial on-site environmental inspection was carried out by the communicable disease control team made up of Public Health nurses and a Public Health inspector. It included a tour of the facility, assessment of hand hygiene practices, personal protective equipment (PPE) use, and environmental cleaning processes. The inspection revealed a lack of access to hand-washing sinks and alcohol-based hand rub (ABHR), insufficient use of PPE and related isolation procedures, and that environmental cleaning products were not being applied per manufacturers' recommendations. Links to resources from Public Health Ontario, Public Health Agency of Canada (PHAC), and the Patient Safety Institute were provided to assist the management of the PCH to establish infection control procedures, including PPE use and appropriate isolation measures for their facility.

The primary focus of the response was to improve access to ABHR, reinforce the need for hand hygiene among staff, and address deficiencies in environmental cleaning practices. In total, eight on-site visits were made over the course of the outbreak to support and encourage the adoption of the advised practices, and to assess progress in this area. Public Health staff provided a 'train the trainer' session to facilitate a review with all staff of how and when they should be cleaning their hands, utilizing resources from the local health region and the Hand Hygiene Practices in Healthcare Settings document from PHAC [10]. Addressing the lack of access to hand-washing sinks and ABHR was a priority to help curb the spread. Installation of wall-mounted ABHR dispensers and provision of staff with small bottles of ABHR to carry with them was recommended. The PCH management voiced concerns, however, that mounting ABHR dispensers would diminish the 'home-like' feeling that they had strived to create, and the unexpected cost delayed the installation of these until the end of the outbreak. Staff were provided with personal-sized bottles of ABHR and facility management initiated a process for auditing whether staff were carrying and using these. When the public health team interviewed staff about their hand hygiene practices, staff reported that they were 'scared' because of the outbreak and cleaning their hands more often; however, none of the staff interviewed were carrying the personal size bottles of ABHR at the time.

Steps to address deficiencies in environmental cleaning involved working with the facility cleaning staff and management to ensure the cleaning products were being applied at the right concentration for disinfecting, and that the recommended wet contact time was observed. Increased attention was paid to disinfection of high-touch surfaces in the common areas and in the GAS-positive resident rooms. Public Health worked with management of the PCH to create checklists of the high-touch surfaces, which were to be cleaned on day and night shifts. The use of chemical test strips and a recording log was advised to test and track that the cleaning products were being dispensed at the correct concentration, but this was not done consistently. Testing by Public Health staff during site visits, however, found that the correct concentration of chemical was present on the housekeeping carts in use on the unit. Environmental sampling was not done.

From December 2017, when the index case was in hospital, through June 2018, 10 cases of GAS were diagnosed with links

Return to TABLE OF CONTENTS

to the facility (attack rate = 3.0% among residents). In addition to the index case, there were two cases in March, six in May, and one in June (Figure 1). The 10 cases were attributable to nine individuals – six residents and three staff. Of the six residents and three staff involved in the outbreak, five (55.6%) were female and four (44.4%) were male. The mean age was 91.5 years among residents, and all were over 80 years of age.

The index case was found to be persistently positive with GAS despite appropriate antibiotic treatments, and another resident was positive for GAS on two separate occasions (repeat infection).

Five of the 10 cases (50.0%), all among residents, were invasive, requiring hospitalization. Three of the five non-invasive cases (60.0%) were among asymptomatic staff, identified upon screening. Eight of the 10 cases (80.0%) were type *emm*92; the remaining two cases (20.0%) – both among asymptomatic staff – were *emm*1.0 and *emm*1.41. (Table 1)

Site visits and interviews revealed that the six resident cases (all *emm*92) lived in the north wing of the building. Cases occurred on all floors of the building, with a significant clustering of four residents in the PCH. The four rooms in the PCH were located in close proximity to one another, and to the north elevator (Figure 2). Indirect contact between the index case and others occurred on various occasions while riding in the north elevator at the same time. The one staff case with *emm*92 had an office in the north wing. This staff member reported indirect contact with the index case and direct contact with two of the iGAS cases. Direct contact occurred after onset of symptoms in the two cases when she was called to assist when each became ill, requiring transfer to hospital, where each was diagnosed with iGAS bacteremia.

All but two cases were negative on repeat screens at 14 and 28 days after treatment initiation. The index case was persistently positive on four different occasions, and one other resident had positive wounds on two occasions (repeat infection).

This was the first GAS outbreak to occur in a private PCH in the Regina area. Because PCHs are privately owned and operated, there are varying degrees of formal infection control programs, and a collaborative approach to identification of and response to the outbreak was required. We found the primary challenges to outbreak control were lack of compliance with

FIGURE 1: Timeline of GAS outbreak at a Regina Personal Care Home, December 2017 to June 2018. (R=resident, S=staff)

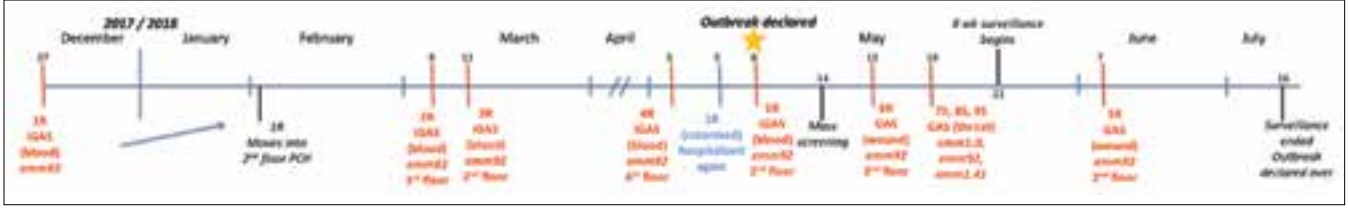


TABLE 1: Characteristics of 10 cases of GAS among nine individuals at the Regina PCH (includes one repeat infection). (R=resident, S=staff)

Case number	ID	New or repeat	Invasive (bacteremia)	Hospitalized	*emm* type
1	1 R	New	Y	Y	92
2	2 R	New	Y	Y	92
3	3 R	New	Y	Y	92
4	4 R	New	Y	Y	92
5	5 R	New	Y	Y	92
6	6 R	New	N	N	92
7	7 S	New	N	N	1.0
8	8 S	New	N	N	92
9	9 S	New	N	N	1.41
10	5 R	Repeat	N	N	92

FIGURE 2: Diagram illustrating the proximity of cases' rooms (yellow) in the North Wing.

Patient room	Patient room iGAS	Patient room	Patient room + GAS x 2	Patient room
North Hallway of the PCH, 2nd Floor				
Patient room	Storage	Patient room + GAS wound	Patient room iGAS Index Case	North Elevator

proper hand hygiene, and lack of proper implementation of PPE, isolation procedures, and environmental cleaning. The lack of adherence to routine practices, like hand hygiene and/or environmental cleaning, likely contributed to GAS transmission. The spatial clustering of seven individuals (comprising eight cases of infection) with *emm*92 either living or working in the north wing of the building also supports the possibility of person-to-person transmission, given the common environment and opportunities for contact. Such spatial clustering of cases within a facility has been previously reported [11]. Unfortunately, since strain typing information was not available, we cannot definitively say that these cases shared the same strain. Propagation of infection by staff within such facilities, along with poor infection control measures, has also been documented as potentially contributing to outbreaks [5]. In this scenario, the outbreak was eventually brought under control when access to hand hygiene materials, appropriate environmental cleaning processes, and use of proper PPE were fully established, further supporting the hand hygiene/environmental contamination hypothesis.

An additional element that likely contributed to this outbreak is the fact that the index case had an underlying dermatological condition that predisposed him to remain colonised with GAS in spite of treatment. Because patients such as this are unlikely to be able to be decolonised, strict infection control process are needed. Such strict controls were not in place in the PCH at the time the index case became a resident, which likely led to environmental contamination and person-to-person spread, most likely by staff at the facility.

Another interesting element of this outbreak was the prevalence of the *emm*92 type. *emm*92 is uncommon both nationally and in the province. In Canada, *emm*1 has generally been the most prevalent *emm* type [12]. Types *emm*81 (17%), *emm*1 (11%), and *emm*41.11 (8%) are the most common in Saskatchewan (Saskatchewan Ministry of Health, personal communication). In the five-year period from 2013-2018, *emm*92 was identified in the Regina area only four times previous to this outbreak – twice in 2016 and twice in 2017. No epi-link was identified for the index case, and the source of his initial infection with *emm*92 remains unknown.

Facilities where elderly residents live together, such as retirement residences or PCHs, with many vulnerable persons living in close proximity, provide an ideal environment for disease transmission. Mitigating this risk requires that facilities establish robust infection control programs, including hand hygiene and effective environmental cleaning. The implication of poor hand hygiene and limited infection control procedures as factors contributing to this outbreak highlight important areas of focus for such facilities. Unlike publicly funded LTCFs, PCHs are privately owned, and operate with no mandatory standards for infection control. Because of this, a collaborative approach between Public Health and PCHs is necessary to ensure the well-being of residents of such private facilities when outbreaks occur.

REFERENCES

1. Steer AC, Lamagni T, Curtis N, Carapetis JR. (2012). Invasive group A streptococcal disease. *Drugs, 72*(9), 1213-1227. doi:10.2165/11634180-000000000-00000
2. Centers for Disease Control and Prevention. (2018). ABCs report: Group A *Streptococcus*, 2016. Retrieved from: https://www.cdc.gov/abcs/reports-findings/survreports/gas16.html.
3. Factor SH, Levine OS, Schwartz B, Harrison LH, Farley MM, McGeer A, et al. (2003). Invasive group A streptococcal disease: risk factors for adults. *Emerging Infectious Diseases, 9*(8), 970–977. doi:10.3201/eid0908.020745
4. High KP, Jordan HT, Richards Jr CL, Burton DC, Thigpen MC, Van Beneden CA. (2007). Group A streptococcal disease in long-term care facilities: descriptive epidemiology and potential control measures. *Clinical Infectious Diseases, 45*(6), 742-752. doi:10.1086/520992
5. Nanduri SA, Metcalf BJ, Arwady MA, Edens C, Lavin MA, Morgan J, et al. (2019). Prolonged and large outbreak of invasive group A *Streptococcus* disease within a nursing home: repeated intrafacility transmission of a single strain. *Clinical Microbiology and Infection, 25*(2), 248-e1. doi:10.1016/j.cmi.2018.04.034
6. Saavedra-Campos M, Simone B, Balasegaram S, Wright A, Usdin M, Lamagni T. (2017). Estimating the risk of invasive group A *Streptococcus* infection in care home residents in England, 2009–2010. *Epidemiology & Infection, 145*(13), 2759-2765. doi:10.1017/S0950268817001674
7. Efstratiou A, Lamagni T. (2017). Epidemiology of *Streptococcus pyogenes*. In *Streptococcus pyogenes*: basic biology to clinical manifestations [Internet]. University of Oklahoma Health Sciences Center.
8. Statistics Canada. (2019). Census Profile, 2016 Census. Retrieved November 6, 2019, from https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.
9. Public Health Agency of Canada. (2009). Invasive group A streptococcal., Retrieved November 6, 2019 from https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2009-35/definitions-communicable-diseases-national-surveillance/invasive-group-streptococcal.html.
10. Public Health Agency of Canada. (2013). Hand hygiene practices in healthcare settings. Retrieved November 6, 2019 from http://publications.gc.ca/site/eng/430135/publication.html.
11. Arnold KE, Schweitzer JL, Wallace B, Salter M, Neeman R, Hlady WG, et al. (2006). Tightly clustered outbreak of group a streptococcal disease at a long-term care facility. *Infection Control & Hospital Epidemiology, 27*(12), 1377-1384. doi:10.1086/508820
12. Public Health Agency of Canada. (2017). National laboratory surveillance of invasive streptococcal disease in Canada – annual summary 2015. Retrieved November 6, 2019 from https://www.canada.ca/en/public-health/services/publications/drugs-health-products/national-laboratory-surveillance-invasive-streptococcal-disease-canada-annual-summary-2015.html.

Return to TABLE OF CONTENTS

CONCISE REPORT

The effect of timing of oseltamivir chemoprophylaxis in controlling influenza B outbreaks in long-term care facilities in Manitoba, Canada, 2017-2018: A retrospective cohort study

Davinder Singh, MD, MSc, JD Student;[1] Depeng Jiang, PhD, Associate Professor;[2] Paul Van Caeseele, MD, Professor;[3] Carla Loeppky, PhD, Assistant Professor[2]

[1]*Faculty of Law, University of Manitoba, Winnipeg, Canada*
[2]*Department of Community Health Sciences, University of Manitoba, Winnipeg, Canada*
[3]*Department of Medical Microbiology, Department of Pediatrics and Child Health, University of Manitoba, Winnipeg, Canada*

Corresponding author:
Dr. Davinder Singh, University of Manitoba, S113 - 750 Bannatyne Avenue, Winnipeg, MB Canada R3E 0W3
Tel: 204-990-2072 | Fax: 204-789-3905 | davinder.singh@umanitoba.ca

ABSTRACT

A retrospective cohort study (n=8) was used to examine the effect of the timing of administration of oseltamivir chemoprophylaxis for the control of influenza B outbreaks among residents in long-term care facilities in Manitoba, Canada during the 2017-2018 influenza season. Delay of oseltamivir chemoprophylaxis was associated with increased odds of influenza-like illness in both univariate and multivariable analyses with an adjusted odds ratio of 1.34 (95% CI: 1.12-1.60) per day for influenza B.

KEYWORDS

Influenza; Outbreak; Long-term care; Oseltamivir; Prophylaxis; Public Health

BACKGROUND

In long-term care (LTC) influenza outbreaks in Manitoba, symptomatic residents receive five days of oral oseltamivir at the therapeutic dose, and all other residents receive 10 days of oseltamivir chemoprophylaxis at the prophylactic dose [1]. This approach is described in many studies, used in other countries, and is similar to the recommendations of the Infectious Diseases Society of America [1-5].

Delayed oseltamivir chemoprophylaxis is associated with increased odds of resident infection during influenza A H3N2 outbreaks in LTC facilities [6], but this has not been studied for influenza B outbreaks. Since oseltamivir is not as effective at treating influenza B as it is for influenza A, the effect of timing of oseltamivir chemoprophylaxis may be different [7]. This study examines the effect of the timing of administration of oseltamivir chemoprophylaxis for the control of influenza B outbreaks among residents in LTC facilities in Manitoba, Canada, controlling for other institutional factors.

METHODS

The main independent variable was the number of days between the true start of the outbreak (the date the second person became ill) and commencement of oseltamivir chemoprophylaxis. The dependent variable was cases of influenza-like-illness (ILI) (yes or no). The control variables, measured at the outbreak beginning, were:

1. number of days between declaring an outbreak and starting oseltamivir chemoprophylaxis,
2. number of days between the first and second cases,
3. prevalence of symptomatic infection among residents,
4. prevalence of symptomatic infection among staff,
5. number of at-risk residents,
6. percentage of residents vaccinated,
7. percentage of staff vaccinated,
8. rural (yes or no),
9. publicly operated facility (yes or no), and
10. percent compliance during hand-hygiene audit.

Acknowledgements: The authors would like to thank all of the Regional Health Authority Ethics Review Boards and Infection Prevention and Control Coordinators from the Winnipeg Regional Health Authority (WRHA), Interlake-Eastern Regional Health Authority (IERHA), Northern Regional Health Authority (NRHA), Prairie Mountain Health (PMH), and Southern Health – Santé Sud (SH) for being so helpful in accessing the necessary data and being collaborative partners.

Authorship and Manuscript Preparation: No drug manufacturers had any involvement, direct or indirect, with any portion of the planning or production of this manuscript.

Conflicts of Interest: *None.*

Funding: *None.*

Outbreaks were included for analysis if:

1. they occurred between October 2017 and May 2018, and;
2. influenza type was determined.

Outbreaks were excluded if the dependent variable or the main independent variable could not be determined, or if another virus, in addition to influenza B, was detected among residents with ILI at the time of the outbreak.

The data were analyzed using a multilevel logistic regression model. All analyses were two-tailed and conducted at an alpha level (α) of 0.05.

Additional details about methods were previously published when examining influenza A H3N2 outbreaks [6].

RESULTS

There were 20 influenza B outbreaks in LTC facilities during the 2017-2018 influenza season. Twelve outbreaks were excluded: five contained the co-detection of respiratory syncytial virus or human coronavirus, three did not report when oseltamivir was started; and four started oseltamivir on different days in different sections of the institution. The characteristics of the eight remaining influenza outbreaks can be seen in Table 1.

Using a univariate analysis, four independent variables were statistically significant (Table 2): the number of days from the second case to starting oseltamivir (t=2.93, df=6, p=0.026), the number of days from declaring an outbreak to starting oseltamivir (t=3.48, df=6, p=0.013), the number of residents at risk (t=3.60, df=6, p=0.011), and rural location (t=2.59, df=6, p=0.041).

Using a stepwise forward-modelling strategy, one variable was found to be statistically significant (Table 2): the number of days from the second case to starting oseltamivir (t=4.18, df=5, p=0.0087). The number of days from the first case to the second case (t=2.08, df=5, p=0.092), and the number of residents at risk (t=2.31, df=5, p=0.068) both trended towards significance in a two-variable model, but the number of days between the first two cases explained more variation in the sample and was included in the final model. The main effects model was assessed for co-linearity and statistically significant interactions; none were found.

The odds ratio of developing ILI for the number of days from the second case to the start of oseltamivir in the final model is 1.34 (95% CI: 1.12 – 1.60). This means that for every day that passes from the second case to the initiation of oseltamivir, the odds of a resident at risk of infection in the facility developing ILI increases by 34%.

DISCUSSION

These data indicate that the sooner oseltamivir chemoprophylaxis is initiated, the lower the odds of secondary infection with influenza during influenza B outbreaks in LTC facilities in Manitoba. This is the first study to provide evidence supporting the rapid detection of influenza B outbreaks, and the rapid administration of oseltamivir chemoprophylaxis in an LTC resident population. Delays in this process can occur at many key points including: early recognition of illness, collection of nasopharyngeal specimens, transport of specimens to the

TABLE 1: Influenza B outbreak characteristics

# of Resid	Primary Cases[1]	Secondary Cases	20 attack rate (%)	Days till prophylaxis[2]	Days 1-2[3]	Days to OB[4]	Prev Resid ILI (%)[5]	Prev Staff ILI (%)[5]	% Staff Vacc[5]	% Resid Vacc[5]	Hygiene Score[6]	Rural (Y/N)[7]	Private (Y/N)[8]
30	2	6	21	13	1	6	7	N/A	24	96.5	68	Y	N
30	2	6	21	5	5	2	7	0	N/A	85	N/A	Y	N
26	2	4	17	11	0	5	8	4	27	81	97	Y	N
148	2	9	6	5	1	5	1	0	40	84	40	N	N
40	3	1	3	8	3	6	8	N/A	N/A	74	N/A	Y	N
200	4	2	1	1	3	1	2	0	91	86	71	N	Y
299	2	4	1	4	0	4	1	0	N/A	89	40	N	N
20	3	0	0	1	2	0	15	N/A	N/A	75	N/A	Y	N

Note: Resid = residents; OB = outbreak; Prev = prevalence; Vacc = vaccinated; N/A = not available; ILI = Influenza-like-illness; ILI is characterized as acute onset of respiratory illness with fever and cough and with one or more of the following: sore throat, arthralgia, myalgia, or prostration that could be due to influenza[1].

1 Primary cases are defined as cases of ILI occurring on or before the day that the second case occurred.
2 Number of days from second case to start of oseltamivir.
3 Number of days between case one and case two of the primary cases.
4 Number of days from second case to declaration of an outbreak.
5 At the start of the outbreak
6 Hand hygiene score in the facility during the 2017-2018 influenza season.
7 Rural = a population less than 10,000 in the 2016 Health Canada Census (1=Yes, 0=No)
8 Facilities not directly operated by the Regional Health Authority (1=Yes, 0=No)

Return to TABLE OF CONTENTS

laboratory, identification of viruses present, communication of results, making the decision to administer oseltamivir chemoprophylaxis, and the actual administration of oseltamivir. Rural LTC facilities experienced longer delays to initiation of oseltamivir, explaining why this variable was statistically significant with univariate analysis, but no longer significant after controlling for the time to initiation of chemoprophylaxis (Table 2). This delay could be caused by increased time to transport samples to the laboratory, and transport oseltamivir from the drug warehouse to the LTC facility in rural Manitoba. Each point of possible delay is an opportunity for a quality improvement analysis to determine if times can be reduced.

Strengths: First, Manitoba employs a common provincial approach to oseltamivir prophylaxis. Second, this study examines secondary attack rate, a more accurate approach than total attack rate. Third, oseltamivir resistance is likely not a confounder since none of the 60 influenza B samples tested in Manitoba for oseltamivir resistance were positive [8]. As well, only one of the 706 influenza B samples tested in Canada for oseltamivir resistance was positive [8]. Fourth, a multilevel model was used, accounting for both the number of outbreaks and the size of the facilities involved.

Limitations: First, the final sample size was small, increasing the likelihood that type 2 errors could be made. This also limits the generalizability of the findings since the facilities included in the analysis may not accurately represent the wider population of LTC facilities. Second, not all cases of ILI received a nasopharyngeal swab. Therefore, some cases of ILI that developed during the outbreaks may have been caused by other respiratory viruses. However, this lack of specificity

TABLE 2: Univariate and final model predictor Odds Ratios for Influenza-like-illness

Independent Variable (n = number of facilities with available information)	Model Predictions for Influenza Infection	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[1]
# Days from 2nd Case of ILI to chemoprophylaxis (n=8)	1.29 (1.04 – 1.59)	1.34 (1.12 – 1.60)
# Days between 1st and 2nd Cases (n=8)	1.07 (0.52 – 2.18)	1.40 (0.92 – 2.11)
# Days from Declaring Outbreak to Chemoprophylaxis (n=8)	1.46 (1.12 – 1.90)	-
Prevalence of ILI among Residents[2] (n=8)	1.08 (0.82 – 1.44)	-
# Residents at Risk[2] (n=8)	0.99 (0.98 – 0.99)	-
Prevalence of ILI among Staff[2] (n=5)	1.48 (0.51 – 4.28)	-
% Staff Vaccinated[2] (n=4)	0.95 (0.90 – 1.01)	-
% Residents Vaccinated[2] (n=8)	1.08 (0.89 – 1.31)	-
Rural[3] (Yes or No) (n=8)	5.58 (1.10 – 28.30)	-
Hand Hygiene Compliance[4] (n=5)	1.03 (0.95 – 1.11)	-
Privately Run[5] (Yes or No) (n=8)	0.13 (0.005 – 3.13)	-

Note: OR = odds ratio; ILI = Influenza-like-illness; ILI is characterized as acute onset of respiratory illness with fever and cough and with one or more of the following: sore throat, arthralgia, myalgia, or prostration that could be due to influenza[1].

1 (-) indicates that this variable was not included in the final model

2 At the start of the outbreak

3 Rural = a population less than 10,000 in the 2016 Health Canada census (1=Yes, 0=No)

4 Hand hygiene score in the facility during the 2017-2018 influenza season. If more than one audit occurred during this time, scores were averaged

5 Facilities not directly operated by the Regional Health Authority (1=Yes, 0=No)

Statistical test: multilevel logistic regression

likely affected all institutions equally at random so only the magnitude of the result should be affected, not the presence of an effect. Third, though this study attempts to control for some of the discrepancy between how various facilities operate, some of these differences may not be accounted for by the control variables and may confound the results in an unpredictable way. Fourth, the analysis does not control for individual factors, such as age, co-morbidities, smoking status, or mobility, among the various LTC facility residents. Therefore, differences such as the number and types of co-morbidities and other demographic differences could be present and affect the results. Fifth, this study does not examine hospitalization or mortality. However, these variables are less sensitive measures of effectiveness.

REFERENCES

1. Government of Manitoba. Communicable Disease Management Protocol: Seasonal Influenza. Winnipeg, Manitoba, August, 2016, Retrieved from:: https://www.gov.mb.ca/health/publichealth/cdc/protocol/influenza1.pdf.
2. Booy R, Lindley RI, Dwyer DE, Yin JK, Heron LG, Moffatt CR, et al. (2012). Treating and preventing influenza in aged care facilities: a cluster randomised controlled trial. PloS one. 7(10),e46509. doi:10.1371/journal.pone.0046509
3. Gorisek Miksic N, Ursic T, Simonovic Z, Lusa L, Lobnik Rojko P, Petrovec M, et al. (2015). Oseltamivir prophylaxis in controlling influenza outbreak in nursing homes: a comparison between three different approaches. Infection. 43(1),73-81. doi:10.1007/s15010-014-0703-4
4. van der Sande MA, Meijer A, Sen-Kerpiclik F, Enserink R, Cools HJ, Overduin P, et al. (2014). Effectiveness of post-exposition prophylaxis with oseltamivir in nursing homes: a randomised controlled trial over four seasons. Emerg Themes Epidemiol. 11,13. doi:10.1186/1742-7622-11-13
5. Uyeki TM, Bernstein HH, Bradley JS, Englund JA, File TM, Fry AM, et al. (2019). Clinical Practice Guidelines by the Infectious Diseases Society of America: 2018 Update on Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management of Seasonal Influenza. *Clin Infect Dis*. *68*(6),895-902. doi:10.1093/cid/ciy874
6. Singh D, Jiang D, Van Caeseele P, Loeppky C. (2018). The effect of timing of oseltamivir chemoprophylaxis in controlling influenza A H3N2 outbreaks in long-term care facilities in Manitoba, Canada, 2014-2015: a retrospective cohort study. *Infect Control Hosp Epidemiol*. *39*(8),955-60. doi:10.1017/ice.2018.115
7. Samson M, Pizzorno A, Abed Y, Boivin G. (2013). Influenza virus resistance to neuraminidase inhibitors. *Antiviral Res*. *98*(2),174-85. doi:10.1016/j.antiviral.2013.03.014
8. Government of Manitoba. Influenza Surveillance Weekly Report: Week 16. Winnipeg, Manitoba May 4, 2018, Retrieved from: https://www.gov.mb.ca/health/publichealth/surveillance/influenza/docs/180428.pdf.

Return to TABLE OF CONTENTS

Trends in health care-associated infections in acute care hospitals in Canada: an analysis of repeated point-prevalence surveys

Robyn Mitchell MHSc, Geoffrey Taylor MD, Wallis Rudnick PhD, Stephanie Alexandre BSc, Kathryn Bush MSc, Leslie Forrester MSc, Charles Frenette MD, Bonny Granfield BScN, Denise Gravel-Tropper MSc, Jennifer Happe MSc, Michael John MD, Christian Lavallee MD, Allison McGeer MD, Dominik Mertz MD, Linda Pelude MSc, Michelle Science MD, Andrew Simor MD, Stephanie Smith MD, Kathryn N. Suh MD, Joseph Vayalumkal MD, Alice Wong MD, Kanchana Amaratunga MD; for the Canadian Nosocomial Infection Surveillance Program

CMAJ 2019 September 9;191:E981-8. doi: 10.1503/cmaj.190361

ABSTRACT

BACKGROUND: Health care-associated infections are a common cause of patient morbidity and mortality. We sought to describe the trends in these infections in acute care hospitals, using data from three national point-prevalence surveys.

METHODS: The Canadian Nosocomial Infection Surveillance Program (CNISP) conducted descriptive point-prevalence surveys to assess the burden of health care-associated infections on a single day in February of 2002, 2009 and 2017. Surveyed infections included urinary tract infection, pneumonia, *Clostridioides difficile* infection, infection at surgical sites and bloodstream infections. We compared the prevalence of infection across the survey years and considered the contribution of antimicrobial-resistant organisms as a cause of these infections.

RESULTS: We surveyed 28 of 33 (response rate 84.8%) CNISP hospitals (6,747 patients) in 2002, 39 of 55 (response rate 71.0%) hospitals (8,902 patients) in 2009 and 47 of 66 (response rate 71.2%) hospitals (9,929 patients) in 2017. The prevalence of patients with at least one health care-associated infection increased from 9.9% in 2002 (95% confidence interval [CI] 8.4%-11.5%) to 11.3% in 2009 (95% CI 9.4%-13.5%), and then declined to 7.9% in 2017 (95% CI 6.8%- 9.0%). In 2017, device-associated infections accounted for 35.6% of all health care-associated infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) accounted for 3.9% of all organisms identified from 2002 to 2017; other antibiotic-resistant organisms were uncommon causes of infection for all survey years.

INTERPRETATION: In CNISP hospitals, there was a decline in the prevalence of health care-associated infection in 2017 compared with previous surveys. However, strategies to prevent infections associated with medical devices should be developed. Apart from MRSA, few infections were caused by antibiotic-resistant organisms.

Health care-associated infections represent substantial burden on health care systems in highly developed countries, including Canada [1–3]. In 2002, health care-associated infection developed in an estimated 5% of patients admitted to hospital in the United States, resulting in 1.7 million infections and 98,000 deaths [1]. A study using 2015 data from the European Antimicrobial Resistance Surveillance Network (EARS-Net) from 30 countries estimated 426,277 infections with antibiotic-resistant bacteria were associated with health care, with an attributable mortality of 33,110 [2]. A point-prevalence study conducted in 2015 estimated that there were 687,200 health care-associated infections in US hospitals [3].

Timely data on the occurrence of health care-associated infections and antimicrobial resistant organisms in Canadian hospitals are essential to the response to an evolving epidemiologic situation. Internationally, prevalence surveys are widely used to estimate the incidence and burden of disease from these infections [3–10].

The Canadian Nosocomial Infection Surveillance Program (CNISP) provides data on the incidence of selected health care-associated infections and antimicrobial resistant organisms [11–15] and conducted point-prevalence surveys in 2002 and 2009 [16, 17]. In 2017, we replicated a point-prevalence survey in CNISP hospitals, to provide an up-to-date estimate of the burden of health care-associated infections and antimicrobial-resistant organisms causing these infections in Canadian hospitals, and to describe the trends observed over time in the three surveys.

METHODS

Sources of data and study population

The Canadian Nosocomial Infection Surveillance Program is a collaboration of the Public Health Agency of Canada (PHAC) and sentinel hospitals across Canada that participate as members of the Canadian Hospital Epidemiology Committee, a subcommittee of the Association of Medical Microbiology and Infectious Disease Canada (Appendix 1, available at www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.190361/-/DC1). Canadian Nosocomial Infection

Surveillance Program hospitals from nine provinces participated in the 2002 and 2009 descriptive point-prevalence surveys, and hospitals from all 10 provinces participated in 2017.

Patients of any age who were admitted to a participating CNISP hospital for 48 hours or longer were eligible for inclusion. Patients who had been admitted for less than 48 hours but were admitted within the last month to the survey hospital were also included. We excluded patients admitted to long-term care, maternity, mental health, day surgery or rehabilitation units.

Case definitions

We defined health care-associated infections using the Centers for Disease Control and Prevention (CDC) National Health care Safety Network standard definitions [18], except for central line-associated bloodstream infections for which we used the CNISP definition [19]. We considered an infection to be present if the patient was symptomatic of, or was receiving antimicrobial therapy to treat, a health care-associated infection on the day of the survey. We collected data on the following: pneumonia, urinary tract infection (UTI), primary and secondary bloodstream infection, infection at surgical sites and infection caused by *Clostridioides difficile*.

Data collection

We identified eligible patients by hospital census on a specified day in February of each survey year. The 2002 survey was conducted in February owing to the timing of budget allocation. To limit the influence of seasonal variation in health care-associated infections and to permit comparison among surveys, the 2009 and 2017 surveys were also conducted in February.

Experienced and trained staff reviewed the medical records of eligible patients for demographic data (age, sex, date of admission and type of ward where the patient was located on the day of the survey) and information on health care-associated infection (infection type, specimen collection date and microbiological etiology when available). In 2017, we collected data on ventilator-associated pneumonia, surgical site infections associated with a prosthetic implant, catheter-associated UTI and central line-associated bloodstream infections. We collected data on methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci and extended-spectrum β-lactamase–producing organisms for all three surveys. Carbapenemase-producing organisms emerged as a concern in Canada in 2010 and were surveyed in 2017 only [14]. Hospital staff who were experienced in collection of surveillance data, use of National Health care Safety Network case definitions and trained in the use of the prevalence survey protocol (infection control professionals) collected data on a standardized form and submitted these forms to the PHAC for data entry, validation and analysis.

We performed double-entry verification, and any inconsistencies in the data were compared with the submitted form and verified by the hospital if required. The Canadian Nosocomial Infection Surveillance Program collects hospital-level data (e.g., bed size, specialized services provided and type of hospital) annually using a standardized hospital profile form. We extracted hospital profile data for CNISP hospitals that participated in the three surveys and included this data in the analysis.

Statistical analysis

We analyzed the data using SAS software (version 9.3). We compared the characteristics of participating hospitals and patients who were surveyed, the prevalence of health care-associated infections and organisms causing infection using standard differences, [20] χ^2 tests, Fisher-Freeman-Halton exact tests for categorical variables or Kruskal-Wallis tests for continuous variables. We considered a two-sided p value of 0.05 or less as significant.

We calculated the prevalence of health care-associated infection as the percentage of the number of patients with at least one infection over the total number of patients surveyed. We used Poisson regression with the survey year as the exposure variable to calculate the differences in prevalence of infection. We used generalized estimating equations to account for clustering by hospital, and to calculate p values and robust standard errors.

Ethics approval

These surveys were either considered exempt as quality assurance projects or approved by the research ethics boards at participating hospitals if required by institution-specific policies.

RESULTS

Twenty-eight of 33 CNISP acute care hospitals (6,747 patients) participated in the 2002 point-prevalence survey (response rate 84.8%), 39 of 55 hospitals (8,902 patients) in 2009 (response rate 71.0%) and 47 of 66 hospitals (9,929 patients) in 2017 (71.2% response rate). Table 1 provides the characteristics of the participating hospitals. Over the three surveys, the hospitals remained similar with respect to geographic distribution, bed size, hospital type and specialized services provided.

Table 2 provides the characteristics of the patients who were surveyed. Although there were differences in the age distribution and there was an increased proportion of patients located in the intensive care unit (ICU) in 2017, the size of the effect was small (< 0.2) for all characteristics.

For all three surveys combined, a total of 2,647 health care-associated infections were reported in 2,447 patients with infection (1.08 health care-associated infections per infected patient).

The prevalence of patients with at least one health care-associated infection increased from 9.9% in 2002 (95% confidence interval [CI] 8.4%-11.5%) to 11.3% in 2009 (95% CI 9.4%-13.5%) followed by a significant decline to 7.9% in 2017 (95% CI 6.8%-9.0%). For all three surveys combined, prevalence of health care-associated infection was higher in patients admitted to ICU, where 16.2% of these patients had at least one health care-associated infection compared with 8.7% of patients in all other units combined ($p < 0.001$). We observed a major decline in the prevalence of infection in patients in the ICU, decreasing from 20.1% in 2002 (95% CI 15.8%-25.5%) to 17.8% in 2009

Return to TABLE OF CONTENTS

(95% CI 13.9%-22.8%) to 12.6% in 2017 (95% CI 10.1%-15.7%).

In an analysis restricted to the 18 hospitals that participated in all three surveys, we found that the prevalence of patients with a health care-associated infection was 9.8% in 2002 (95% CI 7.8%-12.2%) 10.4% in 2009 (95% CI 7.9%-13.7%) and 8.0% in 2017 (95% CI 6.4%-10.1%). Similarly, the prevalence of health care-associated infections in patients in the ICU in these 18 hospitals also declined from 20.2% in 2002 (95% CI 14.9%-27.4%) to 14.3% in 2009 (95% CI 9.9%-20.5%) to 13.9% in 2017 (95% CI 10.8%-17.8%).

Over the three surveys, UTIs (31.9%) were the most common infection type, followed by pneumonia (23.4%), surgical site infection (20.2%), bloodstream infection (15.2%) and *C. difficile* infection (9.3%). The prevalence of patients with a UTI, surgical site infection and *C. difficile* infection declined over time, although not significantly. However, the prevalence of patients with pneumonia and bloodstream infection did significantly decrease from 2.9% in 2002 (95% CI 2.4%-3.6%) to 2.7% in 2009 (95% CI 2.1%-3.5%) to 1.8% in 2017 (95% CI 1.5%-2.3%) for pneumonia, and from 1.8% in 2002 (95% CI 1.4%-2.4%) and 2009 (95% CI 1.4%-2.3%) to 1.2% in 2017 (95% CI 0.9%-1.5%) for bloodstream infection (Figure 1).

In 2017, device-associated infections (i.e., ventilator-associated pneumonia, catheter-associated UTI, surgical site infections associated with a prosthetic implant and central line-associated bloodstream infection) accounted for 35.6% of all health care-associated infections (278 of 780 infections). Of the device-associated infections, catheter-associated UTI accounted for 37.1%, ventilator-associated pneumonia for 22.3%, central line-associated bloodstream infection for 21.2% and surgical site infections associated with a prosthetic implant for 19.4%.

Table 3 presents some selected antimicrobial resistant organisms that cause health care-associated infection. Overall, antimicrobial-resistant organisms remained an uncommon cause of health care-associated infection across all survey years. The most common resistant organism was MRSA, which was present in 6.2% of pneumonia infections, 5.6% of bloodstream infections, 5.0% of surgical site infections and 1.1% of UTIs. Of organisms associated with a bloodstream infection, the proportion of MRSA more than doubled from 3.8% in 2009 to 8.5% in 2017 ($p = 0.1$). Vancomycin-resistant enterococci infrequently caused infection at any site (1.0%, 0.5% and 0.8% of organisms associated with UTIs, surgical site infection and bloodstream infection, respectively). Carbapenemase-producing organisms were identified in only three infections (two *Escherichia coli* and one *Enterobacter* species) in the 2017 survey. Infections associated with extended-spectrum β-lactamases significantly increased in frequency between 2002 (0.4%) and 2017 (2.8%) ($p = 0.01$), and were most common in patients with UTIs.

Among all health care-associated infections, the percentage of *S. aureus* isolates that were methicillin resistant remained consistent from 31.4% (2002) to 28.3% (2009) to 31.4% (2017). Conversely, the percentage of *Enterococcus* species isolates that were vancomycin-resistant increased from 1.9% (2002) to 5.0% (2009) to 8.2% (2017) ($p = 0.12$).

INTERPRETATION

We tracked the burden of health care-associated infections among sentinel Canadian acute care hospitals based on findings from three repeated point-prevalence surveys performed in 2002, 2009 and 2017. We found a significant reduction in health care-associated infections, representing a 30.1% decline in prevalence from 2009 to 2017. For patients in the ICU, we found a 29.2% decline in prevalence of infection from 2009 to 2017. Of the different types of infections measured in all three surveys, the prevalence of pneumonia and bloodstream infection significantly declined; however, we also observed a

TABLE 1: Selected characteristics of participating hospitals for the point-prevalence surveys (2002, 2009 and 2017).

Variable	No. (%) of hospitals* 2002 n = 28	2009 n = 39	2017 n = 47	p value
Participating provinces	BC, AB, SK, MB, ON, QC, NL, NB, NS	BC, AB, SK, MB, ON, QC, NL, NB, NS	BC, AB, SK, MB, ON, QC, NL, NB, NS, PEI	
Region				
Eastern Canada†	6 (21.4)	8 (20.5)	13 (27.7)	
Central Canada‡	12 (42.9)	16 (41.0)	16 (34.0)	0.9
Western Canada§	10 (35.7)	15 (38.5)	18 (38.3)	
Hospital bed size				
Median (IQR)	441 (246–620)	342 (165–487)	290 (203–436)	0.2
Mean ± SD	445 ± 241	354 ± 213	343 ± 222	
Hospital type				
Adult	13 (46.4)	20 (51.3)	23 (48.9)	
Mixed	9 (32.1)	12 (30.8)	17 (36.2)	1.0
Pediatric	6 (21.4)	7 (18.0)	7 (14.9)	
Specialized services				
ICU	28 (100)	37 (94.9)	44 (93.6)	0.45
Hematology–oncology	19 (67.9)	25 (64.1)	26 (55.3)	0.5
Dialysis	18 (64.3)	28 (71.8)	31 (66.0)	0.8
Burn unit	16 (57.1)	14 (35.9)	15 (31.9)	0.1
Solid organ transplant	15 (53.6)	16 (41.0)	16 (34.0)	0.3
Teaching hospital				
Yes	28 (100.0)	36 (92.3)	41 (87.2)	0.1

Note: ICU = intensive care unit, IQR = interquartile range, SD = standard deviation.
*Unless specified otherwise.
†Eastern Canada includes Nova Scotia (NS), New Brunswick (NB), Prince Edward Island (PEI) and Newfoundland and Labrador (NL).
‡Central Canada includes Ontario (ON) and Quebec (QC).
§Western Canada includes Manitoba (MB), Saskatchewan (SK), Alberta (AB) and British Columbia (BC).

Figure 1: Prevalence of health care–associated infection types in Canada in 2002, 2009 and 2017. Note: BSI = bloodstream infection, CDI = *Clostridioides difficile* infection, PNEU = pneumonia, SSI = surgical site infection, UTI = urinary tract infection. Bars represent 95% confidence intervals.

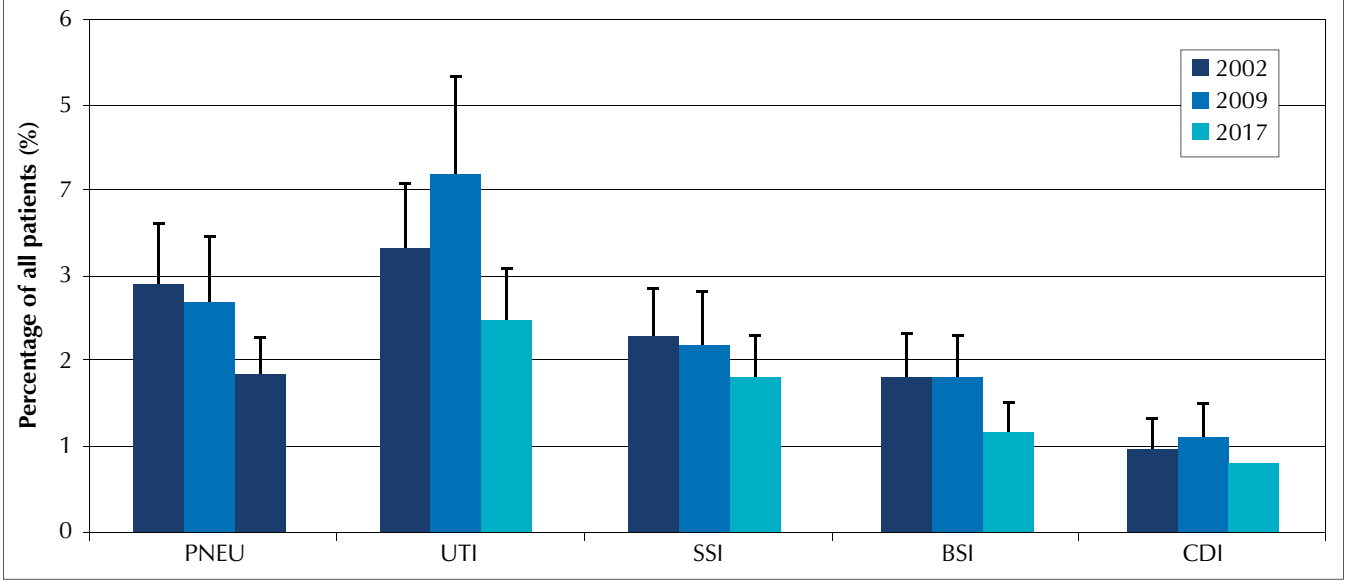


TABLE 2: Selected characteristics of patients who were surveyed in 2002, 2009 and 2017.

Characteristic	No. (%) of patients* 2002 n = 6747	2009 n = 8982	2017 n = 9929	Standardized difference†
Sex, male	3465 (51.7)	4569 (51.5) n = 8865	5217 (52.8) n = 9881	0.03
Age, mean ± SD; yr	56.1 ± 27.0	57.6 ± 27.9 n = 8869	58.3 ± 27.9 n = 9896	0.08
Age group, yr		n = 8869	n = 9896	
Infants (< 1)	493 (7.3)	672 (7.6)	837 (8.5)	0.04
Children (1–17)	481 (7.1)	619 (7.0)	554 (5.6)	0.06
Adults (18–64)	2444 (36.2)	3052 (34.4)	3235 (32.7)	0.07
≥ 65	3329 (49.3)	4526 (51.0)	5270 (53.3)	0.08
Location of patient in hospital on survey day	n = 6736	n = 8864	n = 9912	
Medical/surgical	4882 (72.4)	5934 (66.7)	5664 (57.1)	0.17
ICU	713 (10.6)	1027 (11.5)	1227 (12.4)	0.06
Adult	296 (4.4)	497 (5.6)	583 (5.9)	0.07
Neonatal	355 (5.3)	475 (5.4)	534 (5.4)	0.006
Pediatric	62 (0.9)	55 (0.6)	110 (1.1)	0.05
Hematology/oncology/bone marrow transplant	295 (4.4)	446 (5.0)	526 (5.3)	0.04
Pediatrics	336 (5.0)	376 (4.2)	404 (4.1)	0.04
Critical/coronary care (not ICU)	169 (2.5)	209 (2.4)	348 (3.5)	0.07
Gynecology/obstetrics	123 (1.8)	153 (1.7)	207 (2.1)	0.03
Trauma/burn	104 (1.5)	92 (1.0)	115 (1.2)	0.05
Solid organ transplant	104 (1.5)	184 (2.1)	94 (1.0)	0.09
Other	10 (0.2)	2 (0.02)	174 (1.8)	0.30
No. of days patients had been in hospital on survey day, median (IQR)	10 (5–23) n = 6125	11 (5–27) n = 8809	10 (5–24) n = 9841	0.10

Note: ICU = intensive care unit, IQR = interquartile range, SD = standard deviation.
*Unless specified otherwise.
†Largest absolute standardized difference.

decrease for all other types. In addition, prevalence of health care-associated infections among patients in the ICU markedly declined.

These results are consistent with other CNISP data [11, 20], which suggests improvements in the prevention of health care-associated infections in Canadian acute care hospitals. This trend has occurred despite some changes in hospital-patient populations that would be expected to increase infection risk, such as a higher proportion of patients in the ICU.

No single intervention is likely to have produced a decline in all infection types, suggesting that Canadian hospitals have undertaken multiple interventions to address health care-associated infections [21]. Examples of interventions that have been adopted include improved hand hygiene compliance, multidisciplinary implementation of bundles (e.g., central catheter insertion and maintenance) and antimicrobial stewardship to prevent *C. difficile* infection [22–24]. In our 2017 survey, device-associated infections accounted for 35.6% of all health care-associated infections. In the future, action to address both the need for and safety of these devices is likely to be the most successful approach to reduce the burden of these infections further.

Return to TABLE OF CONTENTS

An important finding of our study is that antimicrobial-resistant organisms other than MRSA remain an uncommon cause of health care-associated infection in the Canadian hospitals that were surveyed; however, their prevalence has increased. Methicillin-resistant *S. aureus* is now widely prevalent as a cause of infection across types, increasingly as a cause of bloodstream infection, reaching 8.5% in 2017. This is a cause for great concern because MRSA associated bloodstream infection is associated with a mortality rate of greater than 20% in patients admitted to hospital [25].

The prevalence of infection associated with extended-spectrum β-lactamases, while remaining low, was highest in 2017. We collected data on carbapenemase-producing organisms in the 2017 survey and found only three infections. The proportion of MRSA (31.4%) and very low frequency of carbapenemase resistance seen in 2017 compares to the prevalence of 45% for MRSA and 5% for carbapenemase-producing organisms in a study of infections in a sample of US hospitals in 2015 [3]. However, the rising MRSA bacteremia data and emerging signs of resistant gram-negative infections in 2017 indicates a need for vigilance and preventive actions to avoid a worsening antibiotic-resistance problem among infections in CNISP hospitals.

TABLE 3: Selected antibiotic-resistant organisms causing health care–associated infection in 2002, 2009 and 2017.

Type of infection	No. (%) of infections* 2002	2009	2017	Total no. (%) of infections* (2002–2017)	*p* value
Urinary tract infection					
Escherichia coli, ESBL	0 (0.0)	14 (3.6)	9 (3.6)	23 (2.6)	0.01
Staphylococcus aureus, MRSA	2 (0.8)	4 (1.0)	4 (1.6)	10 (1.1)	0.9
Enterococcus species, VRE	2 (0.8)	4 (1.0)	3 (1.2)	9 (1.0)	0.9
Klebsiella species, ESBL	0 (0.0)	2 (0.5)	3 (1.2)	5 (0.6)	0.2
Escherichia coli, CPE	NA	NA	2 (0.8)	2 (0.2)	0.6
Total no. of UTI organisms	238	392	248	878	
Pneumonia					
Staphylococcus aureus, MRSA	10 (5.4)	13 (7.0)	8 (6.1)	31 (6.2)	0.1
Escherichia coli, ESBL	0 (0.0)	1 (0.5)	2 (1.5)	3 (0.6)	0.2
Klebsiella species, ESBL	0 (0.0)	0 (0.0)	1 (0.8)	1 (0.2)	0.6
Total no. of pneumonia organisms	185	187	132	504	
Surgical site infection					
Staphylococcus aureus, MRSA	11 (6.5)	9 (4.0)	10 (4.9)	30 (5.0)	0.7
Enterococcus species, VRE	0 (0.0)	1 (0.4)	2 (1.0)	3 (0.5)	0.2
Escherichia coli, ESBL	0 (0.0)	1 (0.4)	3 (1.5)	4 (0.7)	0.2
Enterobacter species, CPE	NA	NA	1 (0.5)	1 (0.2)	0.6
Klebsiella species, ESBL	2 (1.2)	0 (0.0)	1 (0.5)	3 (0.5)	0.4
Total no. of surgical site infection organisms	169	224	202	595	
Bloodstream infection					
Staphylococcus aureus, MRSA	5 (4.8)	6 (3.8)	11 (8.5)	22 (5.6)	0.5
Escherichia coli, ESBL	1 (1.0)	2 (1.3)	0 (0.0)	3 (0.8)	0.2
Enterococcus species, VRE	0 (0.0)	1 (0.6)	2 (1.6)	3 (0.8)	0.2
Klebsiella species, ESBL	0 (0.0)	2 (1.3)	1 (0.8)	3 (0.8)	0.2
Total no. of bloodstream infection organisms	104	157	129	390	
All infections					
MRSA	28 (4.0)	32 (3.3)	33 (4.6)	93 (3.9)	0.9
ESBL	3 (0.4)	22 (2.3)	20 (2.8)	45 (1.9)	0.01
VRE	2 (0.3)	6 (0.6)	7 (1.0)	15 (0.6)	0.3
CPE	NA	NA	3 (0.4)	3 (0.1)	0.4
Total no. of organisms	696	960	711	2367	

Note: CPE = carbapenemase-producing Enterobacteriaceae (surveyed only in 2017), ESBL = extended-spectrum β-lactamase-producing gram-negative bacilli, MRSA = methicillin-resistant *S. aureus*, NA = not available (data not collected), UTI = urinary tract infection, VRE = vancomycin-resistant *Enterococcus*.
*Unless specified otherwise.

The prevalence of health care-associated infections in our surveys (11.3% in 2009 and 7.9% in 2017) are higher than those reported by the CDC (4.0% in 2011 and 3.2% in 2015) [3]. This is likely because our surveys represent data from large, tertiary care hospitals that typically serve patient populations at higher risk for infection compared with general hospitals that were included in the CDC surveys. The distribution and trends in infection in our surveys differed from those found by CDC: in their surveys, pneumonia and *C. difficile* infection were predominant; only surgical site infection and UTI fell in prevalence. The prevalence of health care-associated infections in our 2017 survey (7.9%) was comparable to results reported by a 2016/2017 prevalence survey by the European Centre for Disease Control and Prevention (7.1%) among tertiary care hospitals; [5] however, by excluding low- to very low-risk units such as mental health and maternity, our prevalence could be expected to be slightly higher. Differences in frequency and trends in health care-associated infections among jurisdictions highlights the importance of collecting Canadian data to direct prevention strategies.

Limitations

Our surveys have several limitations. First, our findings may not be representative of the general inpatient population in Canada because the populations examined in these surveys were mainly in large, tertiary acute care hospitals. However, our results provide a robust estimate of health care-associated infections in hospitals of this type in Canada. The Public Health Agency of Canada is

conducting additional prevalence surveys in hospital settings that were not included or underrepresented in these surveys. Second, results were not disaggregated by province; this was to protect the confidentiality of individual hospitals because some provinces have few reporting hospitals. Third, slight changes to the National Health care Safety Network surveillance definitions occurred between the 2009 and 2017 surveys. For example, both the UTI and pneumonia definitions were more specific in 2017 than in 2009. In 2017, a reduction in follow-up period defining surgical site infections occurred, which could reduce the hospital prevalence of these infections [26]. Fourth, laboratory practices have changed over time; for example, laboratories now use more sensitive assays to detect *C. difficile* infection, which could result in an increase in prevalence [27]. Nevertheless, by adopting the same methods, timing, similar definitions, hospital type and case mix, we have attempted to minimize the potential for protocol variation. Fifth, there is a risk of inconsistent adjudication considering turnover of hospital staff reviewing the medical charts. However, we provided standardized training to data collectors to reduce inconsistencies in data collection. Sixth, although patients in maternity wards are susceptible to health care-associated infections, they were excluded as most infections among this population present after the patient's brief hospital stay. For consistency, and to permit comparison among surveys, the decision to exclude maternity patients in the 2002 survey was maintained in 2009 and 2017.

CONCLUSION

Using three sequential point-prevalence studies in a sentinel group of Canadian hospitals between 2002 and 2017, we found a reduction in the prevalence of health care-associated infections overall and that infections caused by antimicrobial-resistant organisms remain uncommon. However, continued efforts in infection prevention and control are required to reduce the burden of health care-associated infections further.

REFERENCES

1. Calfee DP. Crisis in hospital-acquired, health care-associated infections. *Annu Rev Med* 2012;63:359-71.
2. Cassini A, Högberg LD, Plachouras D, et al.; Burden of AMR Collaborative Group. Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis. *Lancet Infect Dis* 2019; 19: 56-66.
3. Magill SS, O'Leary E, Janelle SJ, et al. Emerging Infections Program Hospital Prevalence Survey Team. Changes in prevalence of health care-associated infections in U.S. hospitals. *N Engl J Med* 2018;379:1732-44.
4. Point prevalence survey of health care-associated infections and antimicrobial use in European acute care hospitals: 2011–2012. Stockholm: European Centre for Disease Prevention and Control; 2013. Available: https://ecdc.europa.eu/en/publications/Publications/health care-associated-infections-antimicrobial-use-PPS.pdf (accessed 2019 Mar. 26).
5. Suetens C, Latour K, Kärki T, et al.; The Health care-Associated Infections Prevalence Study Group. Prevalence of health care-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017 [published erratum in Euro Surveill 2018;23:pii: 181122e1]. *Euro Surveill* 2018;23:1800516.
6. Eriksen HM, Iversen BG, Aavitsland P. Prevalence of nosocomial infections in hospitals in Norway, 2002 and 2003. *J Hosp Infect* 2005;60:40-5.
7. Olona M, Limón E, Barcenilla F, et al.; VINCat Program. Prevalence of nosocomial infections in acute care hospitals in Catalonia (VINCat Program). *Enferm Infecc Microbiol Clin* 2012;30(Suppl 3):7-12.
8. van der Kooi TII, Manniën J, Wille JC, et al. Prevalence of nosocomial infections in The Netherlands, 2007–2008: results of the first four national studies. *J Hosp Infect* 2010;75:168-72.
9. Antonioli P, Manzalini MC, Stefanati A, et al. Temporal trends of health care associated infections and antimicrobial use in 2011–2013, observed with annual point prevalence surveys in Ferrara University Hospital, Italy. *J Prev Med Hyg* 2016;57:E135-41.
10. Cai Y, Venkatachalam I, Tee NW, et al. Prevalence of health care-associated infections and antimicrobial use among adult inpatients in Singapore acute-care hospitals: results from the First National Point Prevalence Survey. *Clin Infect Dis* 2017;64(Suppl 2):S61-7.
11. Katz KC, Golding GR, Choi KB, et al.; Canadian Nosocomial Infection Surveillance Program. The evolving epidemiology of *Clostridium difficile* infection in Canadian hospitals during a postepidemic period (2009–2015). *CMAJ* 2018; 190: E758-65.
12. Boyd DA, Mataseje LF, Pelude L, et al.; Canadian Nosocomial Infection Surveillance Program. Results from the Canadian Nosocomial Infection Surveillance Program for detection of carbapenemase-producing *Acinetobacter* spp. In Canadian hospitals, 2010–2016. *J Antimicrob Chemother* 2019;74:315-20.
13. Roth VR, Mitchell R, Vachon J, et al.; Canadian Nosocomial Infection Surveillance Program. Periprosthetic infection following primary hip and knee arthroplasty: the impact of limiting the postoperative surveillance period. *Infect Control Hosp Epidemiol* 2017;38:147-53.
14. Mataseje LF, Abdesselam K, Vachon J, et al. Results from the Canadian Nosocomial Infection Surveillance Program on carbapenemase-producing Enterobacteriaceae, 2010 to 2014. *Antimicrob Agents Chemother* 2016;60:6787-94.
15. Simor AE, Gilbert NL, Gravel D, et al.; Canadian Nosocomial Infection Surveillance Program. Methicillin-resistant *Staphylococcus aureus* colonization or infection in Canada: national surveillance and changing epidemiology, 1995-2007. *Infect Control Hosp Epidemiol* 2010;31:348-56.
16. Rutledge-Taylor K, Matlow A, Gravel D, et al.; Canadian Nosocomial Infection Surveillance Program. A point prevalence survey of health care-associated infections in Canadian pediatric inpatients. *Am J Infect Control* 2012;40:491-6.
17. Taylor G, Gravel D, Matlow A, et al.; Canadian Nosocomial Infection Surveillance Program. Assessing the magnitude and trends in hospital acquired infections in Canadian hospitals through sequential point prevalence surveys. *Antimicrob Resist Infect Control* 2016;5:19.
18. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections

in the acute care setting. *Am J Infect Control* 2008;36:309-32.
19. *Central venous catheter-associated blood stream infections in intensive care units in Canadian acute-care hospitals: surveillance report January 1, 2006 to December 31, 2006 and January 1, 2009 to December 31, 2011*. Ottawa: Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada; 2014. Available: http://publications.gc.ca/collections/collection2014/aspc-phac/HP40-90-2013-eng.pdf (accessed 2019 July 12).
20. Yang D, Dalton JE. A unified approach to measuring the effect size between two groups using SAS®. SAS Global Forum; 2012. Available: https://support.sas.com/resources/papers/proceedings12/335-2012.pdf (accessed 2019 June 12).
21. Yokoe DS, Anderson DJ, Berenholtz SM, et al. Introduction to "A compendium of strategies to prevent health care-associated infections in acute care hospitals: 2014 updates" [published erratum in Infect Control Hosp Epidemiol 2014;35:1081]. *Infect Control Hosp Epidemiol* 2014;35:455-9.
22. AHS report on performance Q2 2018–19: hand hygiene compliance. Edmonton: Alberta Health Services; 2019. Available: www.albertahealthservices.ca/assets/about/publications/ahs-pub-pr-2018-19-q2-objective-07.pdf (accessed 2019 Mar. 26).
23. Gonzales M, Rocher I, Fortin E, et al. A survey of preventive measures used and their impact on central line-associated bloodstream infections (CLABSI) in intensive care units (SPIN-BACC). *BMC Infect Dis* 2013;13:562.
24. Valiquette L, Cossette B, Garant MP, et al. Impact of a reduction in the use of high-risk antibiotics on the course of an epidemic of *Clostridium difficile*-associated disease caused by the hypervirulent NAP1/027 strain. *Clin Infect Dis* 2007; 45(Suppl 2):S112-21.
25. Simor AE, Pelude L, Golding G, et al.; Canadian Nosocomial Infection Surveillance Program. Determinants of outcome in hospitalized patients with methicillin-resistant *Staphylococcus aureus* bloodstream infection: results from national surveillance in Canada 2008–2012. *Infect Control Hosp Epidemiol* 2016;37:390-7.
26. Roth VR, Mitchell R, Vachon J, et al.; Canadian Nosocomial Infection Surveillance Program. Periprosthetic infection following primary hip and knee arthroplasty: the impact of limiting the postoperative surveillance period. *Infect Control Hosp Epidemiol* 2017;38:147-53.
27. Bagdasarian N, Rao K, Malani PN. Diagnosis and treatment of *Clostridium difficile* in adults: a systematic review. *JAMA* 2015;313:398-408.

Competing interests: None declared.

This article has been peer reviewed.

Affiliations: Public Health Agency of Canada (Mitchell, Rudnick, Alexandre, Gravel-Tropper, Pelude, Amaratunga), Ottawa, Ont.; University of Alberta Hospital (Taylor, Granfield, Smith), Edmonton, Alta.; Alberta Health Services (Bush), Calgary, Alta.; Vancouver Coastal Health (Forrester), Vancouver, BC; McGill University Health Centre (Frenette), Montréal, Que.; Infection Prevention and Control Canada (Happe), Edmonton, Alta.; London Health Sciences Centre (John), London, Ont.; Hopital Maisonneuve-Rosemont (Lavallee), Montréal, Que.; Mount Sinai Hospital(McGeer), Toronto, Ont.; Department of Medicine, McMaster University and Hamilton Health Sciences (Mertz), Hamilton, Ont.; Hospital for Sick Children (Science); Sunnybrook Health Sciences Centre (Simor), Toronto, Ont.; The Ottawa Hospital (Suh, Amaratunga), Ottawa, Ont.; Alberta Children's Hospital (Vayalumkal), Calgary, Alta.; Royal University Hospital (Wong), Saskatoon, Sask.

Contributors: Robyn Mitchell and Wallis Rudnick performed the data analysis. Robyn Mitchell and Geoffrey Taylor interpreted the data and drafted the initial manuscript. All of the authors contributed to conception and design of the work, and data acquisition; revised the manuscript critically for important intellectual content, gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding: The Public Health Agency of Canada provided funding for the Canadian Nosocomial Infection Surveillance Program.

Data sharing: Study protocols are available. Data-sharing requests will be considered and reviewed by the Public Health Agency of Canada and individual site investigators.

Acknowledgements: The authors gratefully acknowledge the contributions of the epidemiologists, infection control practitioners and staff for their data collection and submission at each participating hospital, as well as the following members of the Canadian Nosocomial Infection Surveillance Program who participated in the 2002, 2009 and 2017 point-prevalence surveys: Bonita E. Lee, Stollery Children's Hospital, Edmonton, Alta.; Camille Lemieux, University Health Network, Toronto, Ont.; Chelsea Ellis, The Moncton Hospital, Moncton, NB; Deanna Hembroff, University Hospital of Northern BC, Prince George, BC; Elizabeth Bryce, Vancouver General Hospital, Vancouver, BC; Elizabeth Henderson, Alberta Health Services, Calgary, Alta.; Eva Thomas, BC Children's Hospital, BC Women's Hospital, Vancouver, BC; Gerald A. Evans, Kingston General Hospital, Kingston, Ont.; Ghada Al-Rawahi, BC Children's Hospital, BC Women's Hospital, Vancouver, BC; Gregory German, Queen Elizabeth Hospital, Charlottetown, PEI; Ian Davis, QEII Health Sciences Centre, Halifax, NS; Janice de Heer, Interior Health Authority, Kelowna, BC; Jeannette Comeau, IWK Health Centre, Halifax, NS; Jerome Leis, Sunnybrook Health Sciences Centre, Toronto, Ont.; Jessica Minion, Regina Qu'Appelle Health Region, Regina, Sask.; Joanne Embree, Health Sciences Centre, Winnipeg, Man.; Joanne M. Langley, IWK Health Centre, Halifax, NS; Jocelyn Srigley, BC Children's Hospital, BC Women's Hospital, Vancouver, BC; Johan Delport, London Health Sciences Centre, London, Ont.; John Conly, Foothills Medical Centre, Calgary, Alta.; John Embil, Health Sciences Centre, Winnipeg, Man.; Karl Weiss, Maisonneuve-Rosemont Hospital, Montréal, Que.; Kathy Malejczyk, Reginal Qu'Appelle Health Region, Regina, Sask.; Kevin C. Katz, North York General Hospital, Toronto, Ont.; Lynn Johnston, QEII Health Sciences Centre, Halifax, NS; Marie-Astrid Lefebvre, Montreal Children's Hospital, Montréal, Que.; Mark Loeb, McMaster University and Hamilton Health Sciences, Hamilton, Ont.; Mary Vearncombe, Sunnybrook Health Sciences Centre, Toronto, Ont.; Natalie Bridger, Eastern Health-HSC, St. John's, Nld.; Nisha Thampi, Children's Hospital of Eastern Ontario, Ottawa, Ont.; Pamela Kibsey, Royal Jubilee Hospital, Victoria, BC; Paula Stagg, Western Memorial Hospital, Corner Brook, Nld.; Sarah Forgie, Stollery Children's Hospital, Edmonton, Alta.; Stephanie Smith, University of Alberta Hospital, Edmonton, Alta.; Susan Richardson, Hospital for Sick Children, Toronto, Ont.; Susy Hota, University Health Network, Toronto, Ont.; Titus Wong, Vancouver General Hospital, Vancouver, BC; Valerie Wood, Interior Health Authority, Kelowna, BC; Virginia Roth, The Ottawa Hospital, Ottawa, Ont.; Yves Longtin, SMBD-Jewish General Hospital, Montréal, Que.

Accepted: July 11, 2019

Correspondence to: Geoffrey Taylor, *geoff.taylor@ualberta.ca*

CALL FOR PAPERS

The *Canadian Journal of Infection Control* is a leading international peer-reviewed journal providing a platform for knowledge transfer and academic discourse in the field of infection prevention and control and hospital epidemiology. The journal invites submission of manuscripts outlining original research that examines, informs, and advances this professional field.

Authors should follow the content and format recommendations as outlined in the journal's Guidelines for Authors (**https://ipac-canada.org/canadian-journal-of-infection-control-3.php**). Manuscripts are accepted in English and French and should be submitted electronically by emailing all materials to the attention of:

Victoria Williams, Editor-in-Chief
Canadian Journal of Infection Control
editor-in-chief@ipac-canada.org

A signed copy of IPAC Canada's Publisher-Author agreement must be received before a manuscript will be published. The agreement is available at **https://ipac-canada.org/canadian-journal-of-infection-control-3.php**. Please note that there is an approximate three- to four-month timeline between receipt of manuscript, peer review, editing, and publication. The *Canadian Journal of Infection Control* is a quarterly publication indexed by the Cumulative Index to Nursing and Allied Health Literature (CINAHL)/EBSCO, SilverPlatter Information, Inc. and CrossRef.

ipac pci
Infection Prevention and Control Canada
Prévention et contrôle des infections Canada

OUR CONCERN FOR THE ENVIRONMENT 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 CouncilTM (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.

Data-Driven Approach to Hand Hygiene Compliance

MONITORING THE PATIENT ZONE

The Ecolab® Hand Hygiene Compliance Monitoring System, an electronic handwashing detection solution, digitally records hand hygiene events by individual, holding each healthcare worker accountable for his or her compliance.

Our proprietary badge technology recognizes custom **patient zones** around each bed, detects compliance before and after each patient interaction and provides actionable, real-time guidance for improvement. This helps achieve and sustain results by individual, deliver better patient outcomes and provide a safer work environment for your staff.

Take a data-driven approach to hand hygiene compliance
Visit www.ecolab.com/compliancemonitoring

ECOLAB®

Added Assurance.

Make It Part Of Every Patient Care Plan.

Accel® Wipes deliver effective, one-step cleaning and disinfection with a choice of dwell times.

- Effective against key pathogens – including MRSA, VRE, TB, and Norovirus.
- Pre-wetted disinfectant cleaner wipes based on proprietary AHP® - Accelerated Hydrogen Peroxide technology to deliver fast, effective, responsible cleaning performance. Compatible with most hard, non-porous surfaces.
- After use the key ingredient breaks down into oxygen and water.

Accel® INTERvention™
1 min. dwell time

Accel® PREvention™
3-5 min. dwell time

MoonBeam™3 provides added assurance with fast, effective UV-C disinfection.

- Destroys pathogens that cause HAIs in as little as 3 minutes.
- Adds assurance to manual cleaning and disinfection, reducing the risk for patients and staff.
- Individually adjustable light arms deliver a powerful UV-C light dose straight and close to disinfect high-touch surfaces. Fast, targeted dosing reduces labor and operation costs.
- MoonBeam3 is portable and affordable, facilitating use in more places.

SOLUTIONS DESIGNED FOR HEALTHCARE™

Explore disinfection solutions at **sdfhc.com**

TOMI™ | STERAMIST® HEALTHCARE

DISCOVER WHY **STERAMIST®** IS THE PERFECT FIT FOR YOUR HEALTHCARE FACILITY

- FEATURING A **7.8% HYDROGEN PEROXIDE ENHANCED, NO-TOUCH SOLUTION** FOR EVERYDAY USE
- FIGHT CROSS-CONTAMINATION WITH POWERFUL **iONIZED HYDROGEN PEROXIDE (iHP™)** DISINFECTION

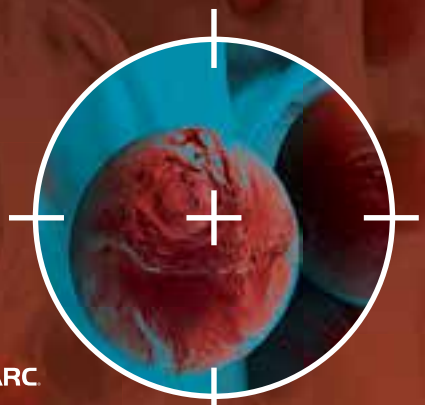
OMRI® LISTED
For Organic Use

HEALTH CANADA APPROVED
DIN No. 02469448

ENHANCE FACILITY PROTOCOLS WITH **STERAMIST®** TECHNOLOGY

TOMIMIST.COM
800.525.1698

FIRST AND ONLY ***HEALTH CANADA-REGISTERED*** *PRODUCT*
AGAINST BIOFILMS



SANI MARC

BIOASSURE™ MC

DIN 02456435

KILLS BACTERIA IN **BIOFILMS** IN **DRAINS** IN 5 MINUTES
KILLS AND REDUCES THE SPREAD OF **SUPERBUGS**

ASK A QUESTION	*GET MORE INFO*	*ASK FOR A DEMO*
1 800 361-7691	**sanimarc.com/bioassure**	**sales@sanimarc.com**

BIOASSURE products are distributed by Wood Wyant, a subsidiary of Sani Marc Group.

WOOD WYANT
Subsidiary of Sani Marc Group

ASEPT.1X
24/7 Automated Pathogen Protection

The worlds first fully automatic fixed UVC Disinfection System utilizes smart sensor technology designed to continually disinfect the most contaminated and problematic areas of a medical facility patient bathrooms or equipment rooms.

SANUVOX

- ☑ No-Touch Disinfection (NTD) solution for unoccupied bathrooms.
- ☑ Irradiate all high-touch areas with high-intensity UVC light.
- Reduces risk of HAI by reducing C.Diff, VRE & other pathogens.
- Automated 5 minute disinfection cycle following each bathroom use.

SMARTFLO$_3$
Hand Hygiene Sink

The world's first self-disinfecting sink uses ozonated water to reduce bacteria on hands, on the sink and in the drain trap. No splash, no faucet, no problems!

- ☑ Motion activated and self-flushing.
- ☑ Exceeds CSA Z317.1-16 requirements.
- ☑ UV compatible coating.
- Prevents bacterial growth and biofilm.

FRANKE

Proud to be a founding member of chaircanada.org

CHAIR
Coalition for Healthcare Acquired Infection Reduction

Contact us for more information at
(888) 885-9030 | info@prescientx.com

www.prescientx.com

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*.

Company	Page	Phone	Web Site
3M Canada	165	800-364-3577	www.3M.ca
Alberta Health Services	OBC		www.ahs.ca/ipc
AMG Medical Inc.	IBC	800-363-2381	www.amgmedical.com
BD	199	866.979.9408	www.bd.com
Clorox Healthcare	162, 163	866-789-4973	www.cloroxhealthcare.ca
Diversey	194, 201	800-668-7171	www.sdfhc.com
Ecolab USA Inc.	193	800-352-5326	www.ecolab.com/healthcare
Glo Germ Company	168	435-259-5931	www.glogerm.com
GOJO Canada, Inc.	202	800-321-9647	www.gojocanada.ca
Hygie Canada	166	866-588-2221	www.hygie.com
Medco Equipment	167	800-717-3626	www.medcoequipment.com
Prescientx	197	519-749-5267	www.prescientx.com
Process Cleaning Solutions	200	877-745-7277	www.processcleaningsolutions.com
Retractable Technologies, Inc.	164	888-703-1010	www.retractable.com
Sani Marc Group	196	800-361-7691	www.sanimarc.com
SciCan Ltd.	203	800-667-7733	www.scican.com
SJ High-Tech Pro Ltd.	198	416-357-8441	
Tagg Design Inc.	172	416-249-2220	www.taggcleanhands.com
The Stevens Company Limited	204	800-268-0184	www.stevens.ca
TOMI Environmental Solutions, Inc.	195	800-525-1698	www.tomimist.com
Vernacare Canada Inc.	161	800-268-2422	www.vernacare.com
Virox Technologies Inc.	IFC	800-387-7578	www.virox.com

THE DIFFERENCE OF
99.99% REDUCTION IN BACTERIA*

EMPOWERING CLINICIANS TO ADDRESS A CAUSE OF CLABSI FOR BETTER PATIENT OUTCOMES. In the fast-paced world of healthcare, clinicians strive tirelessly for better patient outcomes. However, studies have shown that lack of compliance with scrubbing the needle-free connector hub can lead to infections, such as central line-associated bloodstream infection (CLABSI). The BD PureHub™ disinfecting cap provides a 99.99% reduction in bacteria most commonly linked to CLABSI within 1 minute of application by disinfecting with a sterilized 70% IPA solution. Designed for compatibility with leading needle-free connectors, it also maintains a physical barrier to contamination for up to 7 days, which can result in reduced risk of CLABSI and improved patient outcomes. Discover how clinicians can be empowered with this standardized approach to disinfection. **Discover the new BD**.

Learn more at **bd.com/PureHub**

BD

*Demonstrated reduction on *Staphylococcus aureus, Staphylococcus epidermidis, Acinetobacter baumannii, Pseudomonas aeruginosa, Escherichia coli, Candida glabrata* and *Candida albicans*, as tested in a laboratory

HEALTH CARE

Neutral pH PCS 250 Oxidizing Disinfectant/ Disinfectant Cleaner
Use to clean frequently touched surfaces.
Apply to surface and wipe dry.
DIN: 02314843

APPLY AND DRY
PCS
PROCESS CLEANING SOLUTIONS
CLEANING TO PROTECT PUBLIC HEALTH

INSTITUTIONAL CLEANING

PCS Friction Natural Organic Multi-Purpose Cleaner
Use to clean frequently touched surfaces.
Apply to surface and wipe dry.

SAFE
PCS non hazardous low concentration, of non caustic, non toxic,neutral ph sodium hypochlorite solution.

EFFECTIVE
Proven in three separate hospital trials to lower residual microbial bioburden to less than 1 colony forming unit per square centimeter after cleaning as compared to current hospital cleaning practices that averaged 2.797 CFU per square centimeter. *Industry leaders have proposed a standard of less than 1 CFU per square centimeter after cleaning. Recent American Journal of Infection Control 47 (2019) 1375–1381article reported generic sodium hypochlorite at 200 ppm demonstrated a 5 log reduction of C.difficile spores from contaminated cotton fabric with an 8 minute soak. Alkaline detergent, 640 ppm hydrogen peroxide, 300 ppm of Peracetic acid pH 3 and 300 ppm of Peracetic acid at pH 9 all had no effect on C.difficile spores.

ENVIRONMENTALLY RESPONSIBLE
ENVIRODESIC

Leaves no toxic residue.
Contains 95% less bleach solution.
Natural formulation contains no synthetic chemicals. Endorsed and certified by the Envirodesic™ Certification Program for Maximum Indoor Air Quality™ and minimum environmental health impact.

CLEANING WITHOUT TRANSFERRING PATHOGENS•
PCS Apply and Dry cleaning results demonstrated significantly better removal of pathogens and prevention of transfer of pathogens to adjacent surfaces. Previous QCT-3 studies demonstrated wiping high touch surfaces with pre-moistened wipes or cloths transferred Murine norovirus and C.difficile spores to clean surfaces, this occurred with all major classes of disinfectants.

Neutral PH PCS 250 Oxidizing Disinfectant /Disinfectant Cleaner DIN 02314843

Code	Description	Case Pk
#5908NPH-6	946 mL	6/cs
#6048-6	70 container wipes 7" x 12" 500 mL container PCS 250 Oxidizing Disinfectant/ Disinfectant Cleaner	6/cs.

PCS Friction
Natural Organic Multi-Purpose Cleaner

Code	Description	Case Pk
#6070-6	946 mL	6/cs
#6079-6	70 container wipes 7" x 12" 500 mL container PCS Friction	6/cs.

*CLEANING WITHOUT TRANSFERRING INFECTIOUS DOSE OF PATHOGENS

PCS
PROCESS CLEANING SOLUTIONS
Bringing Science to the Art of Cleaning

Diversey™

A Safe, Satisfying Environment of Care

Achieve It With Effective Disinfection – Start to Finish.

Oxivir® Tb Wipes

One-step, one-wipe, one-minute cleaning and disinfection of hard surfaces.

MoonBeam™3 UV-C Disinfection

Fast. Effective. Portable. Affordable. Destroys pathogens that cause HAIs in as little as 3 minutes.

SOLUTIONS DESIGNED FOR HEALTHCARE™

Explore disinfection solutions at **sdfhc.com**

Our Purpose is to Save Lives

By effectively and efficiently monitoring hand hygiene performance, we help you take a data-driven approach to deliviering a higher standard of care.

PURELL SMARTLINK™ electronically monitors hand hygiene 24/7. When combined with clinical interventions, scientifically proven PURELL formulations, and advanced dispensing platforms, our solution is proven to increase hand hygiene performance 82% over baseline.[1]

Learn how PURELL®, Canada's #1 hand sanitizer brand[2], uses technology and clinical expertise to help improve your hand hygiene initiatives and ensure patient safety.

GOJOCanada.ca/SMARTLINK

Purell SMARTLINK™

1. University of Chicago Medicine Hand Hygiene Performance Rates September 2016 - February 2017, GOJO Industries, Inc., February 2017
2. Nielsen Sales 52wk ending 1/5/19

11/2019 (#29557)

9 out of 10 times Invasive Aspergillosis is lethal

to immuno-compromised patients[1].

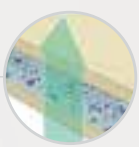
Aspergillus spp.

PLASMAIR™ equipped rooms
have **12.6 times less infections**[2]

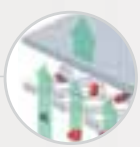
PLASMAIR™ HEPA-MD™ technology

4 stages reactor

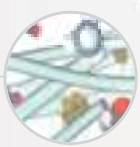
STAGE 1
Destruction of microorganisms.



STAGE 2
HEPA filtration.



STAGE 3
Elimination of oxidant chemical molecules.



STAGE 4
Adsorption of Volatile Organic Compounds and odours removal.

GET MORE INFO
www.scican.com/medical/plasmair

[1] Sixt N, Dalle F, Lafon I, Aho S, Couillault G, Valot S, et al. Reduced fungal contamination of the indoor environment with the PLASMAIR™ system (Airinspace). J Hosp infect 2007; 65:156-162.
[2] Fernandez-Gerlinger MP, Jannot AS, Rigaudeau S, Lambert J, Eloy O, Mignon F, Farhat H, Castaigne S, Merrer J Rousselot P.
The PLASMAIR™ decontamination system is protective against Invasive Aspergillosis in neutropenic patients. Infect Control Hosp Epidemiol 2016; 37: 845-851.
PLASMAIR is a registered trademark of airinspace™. Manufactured by airinspace™ 14, rue Jean Monnet, 78990 Élancourt, France.

SciCan

STEVENS

Inspired by the care you deliver

Your Infection Control Partner for the past 145 years!

145 YEARS IN CANADA STEVENS 1874 2019

CELEBRATING 130 YEARS IN BRITISH COLUMBIA STEVENS 1889 2019

CELEBRATING 100 YEARS IN ALBERTA STEVENS 1919 2019

3M aegis Diversey GOJO Coloplast CLEANPatch MEIKO Metrex Mölnlycke PDG clinell

Seal Integrity and Validation

WIPAK

Where medical devices are packed for sterilization, the user is responsible for assuring the performance of the final closing seal of a package. Steriking® Seal Control is designed for operational qualification of the sealing process.

Learn more

Steriking® Smart Dye Tests

- A new generation of ink tests to control the performance of a sealing device and its seal integrity in accordance with the appropriate ISO
- Identifies defects quickly and clearly, as soon as the ink is pushed into the pack

Steriking® Multi Seal Test Kit

For testing the integrity of the seal made by any Rotosealer™ units.

Kit Includes:

- Seal control sheets
- 80mL bottle of integrity test dye
- Stopwatch
- Registration card
- Instructions for use

Steriking® Seal Control Sheets

- A practical Seal Control Sheet for daily heat-sealer validation and seal quality test
- Made from the same material as the Steriking® sterilization pouches

Contact Stevens today for a Customized Consultation

www.stevens.ca

Eastern Canada
1-800-565-0765
ACCS@stevens.ca

Québec
1-855-660-7750
QCSAC@stevens.ca

Ontario
1-800-268-0184
ONCS@stevens.ca

Manitoba
1-800-665-0368
MBCS@stevens.ca

Midwestern Canada
1-800-665-0368
MBCS@stevens.ca

Western Canada
1-800-565-8444
BCCS@stevens.ca

ID# 1569259280

Same **powerful sporicide** now more versatile

INTRODUCING THE NEW

nocospray®

The **New Nocospray Disinfection System** can disinfect **twice the space** and comes equipped with onboard **data tracking** to help you achieve even better results with the push of a button.

Find out more and schedule your on-site demonstration in time for Capital Budget season.

Call 1-800-363-2381 or visit us at www.medprodefense.com

MedPro DEFENSE®

Rev 1119

Together, we do amazing things every day

We're leaders in our work. We support patients, their families, staff, physicians and volunteers across the continuum of care.

Our Infection Prevention and Control program is one of a kind. With province-wide surveillance, hand hygiene initiatives, medical device reprocessing quality reviews, and various education and best practice resources, we work collaboratively to integrate IPC principles into all aspects of patient care.

Learn more at ahs.ca/ipc.

Alberta Health Services

Infection Prevention & Control

Healthy Albertans.
Healthy Communities.
Together.

Canada's Top 100 Employers 2018

Alberta's TOP 70 EMPLOYERS 2017

Canada's Top Employers for Young People 2018