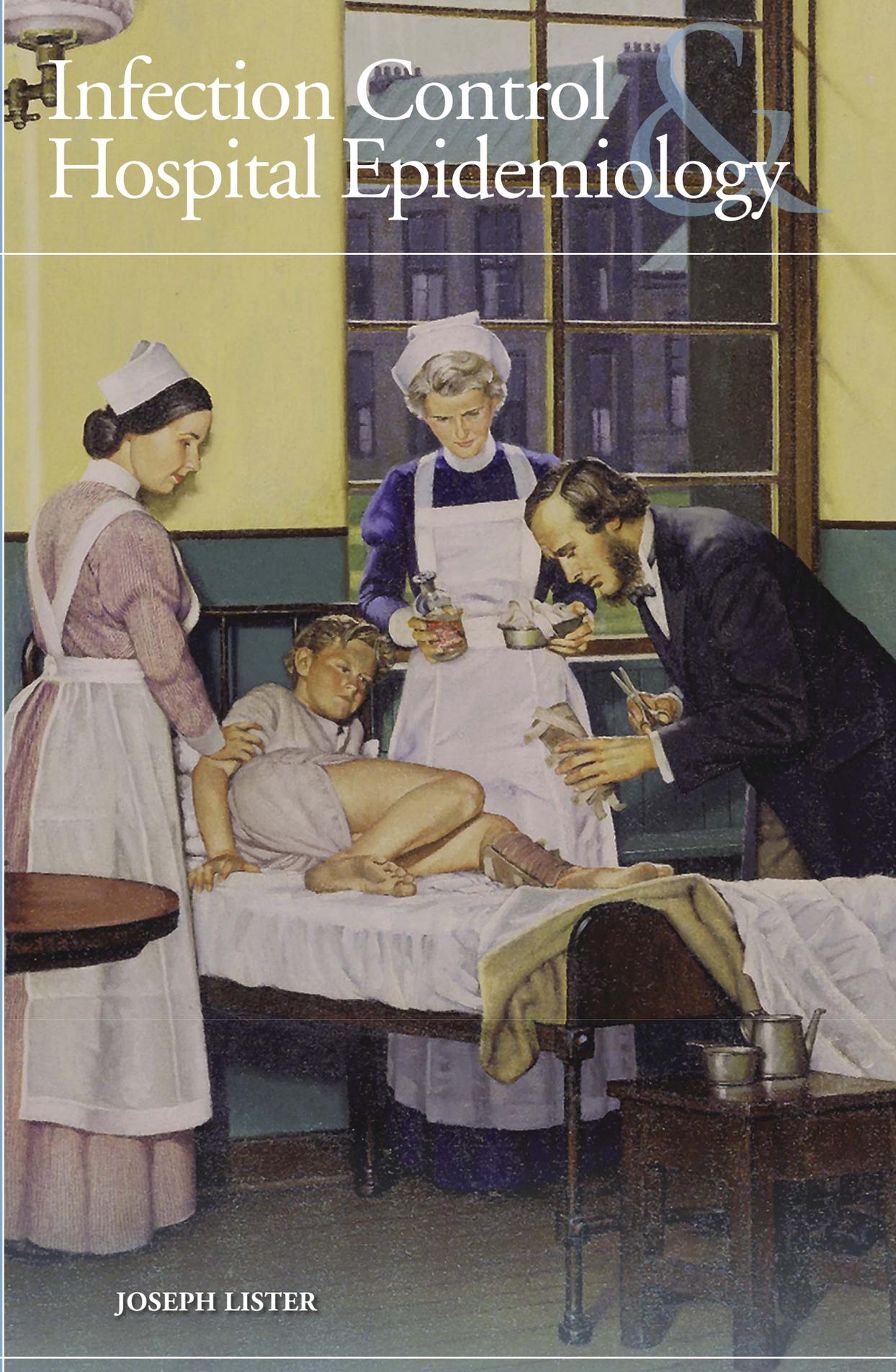


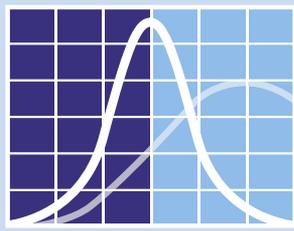
Volume 38, No 2

# ICHE



FEBRUARY 2017

JOSEPH LISTER



**SHEA**  
The Society for Healthcare  
Epidemiology of America

SHEASPRING.ORG | #2017SHEA

SHEA Spring 2017 Conference  
**SCIENCE GUIDING PREVENTION**

**March 29-31, 2017**

HYATT REGENCY ST. LOUIS  
AT THE ARCH



**FEATURING**

Separate tracks of education focused on Innovative topics addressing unanswered issues in  
Healthcare Epidemiology & Antibiotic Stewardship



Opportunity to Submit  
Scientific Abstracts



Re-Launch of the SHEA  
Epi Project Competition



Ability to participate in the  
SHEA Mentorship Program

## CONTENTS

## Original Articles

- 131** Association Between Storage Interval and Contamination of Reprocessed Flexible Endoscopes in a Pediatric Gastrointestinal Procedural Unit  
*Patricia Scanlon, Kathleen Flaherty, Erik A. Reilly, Ellen G. Barth, Gail Potter-Bynoe, Jeff Cardini, Ann Marie Riley, Alexander J. McAdam and Thomas J. Sandora*
- 136** Disposable Bronchoscope Model for Simulating Endoscopic Reprocessing and Surveillance Cultures  
*Mohamed H. Yassin, Rahman Hariri, Yasir Hamad, Juliet Ferrelli, Leeanna McKibben and Yohei Doi*
- 143** Challenging Residual Contamination of Instruments for Robotic Surgery in Japan  
*Yuhei Saito, Hiroshi Yasuhara, Satoshi Murakoshi, Takami Komatsu, Kazuhiko Fukatsu and Yushi Uetera*
- 147** Periprosthetic Infection following Primary Hip and Knee Arthroplasty: The Impact of Limiting the Postoperative Surveillance Period  
*Virginia R. Roth, Robyn Mitchell, Julie Vachon, Stéphanie Alexandre, Kanchana Amaratunga, Stephanie Smith, Mary Vearncombe, Ian Davis, Dominik Mertz, Elizabeth Henderson, Michael John, Lynn Johnston, Camille Lemieux, Linda Pelude, Denise Gravel and the Canadian Nosocomial Infection Surveillance Program*
- 154** Prosthetic Joint Infection Following Invasive Dental Procedures and Antibiotic Prophylaxis in Patients With Hip or Knee Arthroplasty  
*Feng-Chen Kao, Yao-Chun Hsu, Wen-Hui Chen, Jiun-Nong Lin, Ying-Ying Lo and Yuan-Kun Tu*
- 162** Is It Valid to Compare Surgical Site Infections Rates Between Countries? Insights From a Study of English and Norwegian Surveillance Systems  
*Hinta Meijerink, Theresa Lamagni, Hanne Merete Eriksen, Suzanne Elgohari, Pauline Harrington and Oliver Kacelnik*
- 172** Interrater Reliability of Surveillance for Ventilator-Associated Events and Pneumonia  
*Meeta Prasad Kerlin, William E. Trick, Deverick J. Anderson, Hilary M. Babcock, Ebbing Lautenbach, Renaud Gueret and Michael Klompas for the CDC Prevention Epicenters*
- 179** Grouped Cases of Pulmonary Pneumocystosis After Solid Organ Transplantation: Advantages of Coordination by an Infectious Diseases Unit for Overall Management and Epidemiological Monitoring  
*Claire Wintenberger, Daniele Maubon, Elena Charpentier, John Rendu, Patricia Pavese, Caroline Augier, Paolo Malvezzi, Boubou Camara, Marie-Reine Mallaret, Laurence Bouillet and Olivier Epaulard*
- 186** A Multifaceted Approach to Reduction of Catheter-Associated Urinary Tract Infections in the Intensive Care Unit With an Emphasis on “Stewardship of Culturing”  
*Katherine M. Mullin, Christopher S. Kovacs, Cynthia Fatica, Colette Einloth, Elizabeth A. Neuner, Jorge A. Guzman, Eric Kaiser, Venu Menon, Leticia Castillo, Marc J. Popovich, Edward M. Manno, Steven M. Gordon and Thomas G. Fraser*
- 189** Frequency of Use of Alcohol-Based Hand Rubs by Nurses: A Systematic Review  
*John M. Boyce, Philip M. Polgreen, Mauricio Monsalve, David R. Macinga and James W. Arbogast*

---

**Cover image: Detail of Lister Introduces Antisepsis, from “The History of Medicine” by Robert Thom, used with permission from University of Michigan Museum of Art.**

- 196** A Comprehensive Study of Costs Associated With Recurrent *Clostridium difficile* Infection  
*Rodrigo Rodrigues, Grant E. Barber and Ashwin N. Ananthakrishnan*
- 203** Incidence and Outcomes Associated With Infections Caused by Vancomycin-Resistant Enterococci in the United States: Systematic Literature Review and Meta-Analysis  
*Hsiu-Yin Chiang, Eli N. Perencevich, Rajeshwari Nair, Richard E. Nelson, Matthew Samore, Karim Khader, Margaret L. Chorazy, Loreen A. Herwaldt, Amy Blevins, Melissa A. Ward and Marin L. Schweizer*

#### Review Article

- 216** Understanding the Impact of Interventions to Prevent Antimicrobial Resistant Infections in the Long-Term Care Facility: A Review and Practical Guide to Mathematical Modeling  
*Alicia Rosello, Carolyne Horner, Susan Hopkins, Andrew C. Hayward and Sarah R. Deeny*

#### Concise Communications

- 226** Acceptability and Necessity of Training for Optimal Personal Protective Equipment Use  
*Michelle Doll, Moshe Feldman, Sarah Hartigan, Kakotan Sanogo, Michael Stevens, Myriah McReynolds, Nadia Masroor, Kaila Cooper and Gonzalo Bearman*
- 230** Revisiting the WHO “How to Handrub” Hand Hygiene Technique: Fingertips First?  
*Daniela Pires, Fernando Bellissimo-Rodrigues, Hervé Soule, Angèle Gayet-Ageron and Didier Pittet*
- 234** Serologic Evaluation of MERS Screening Strategy for Healthcare Personnel During a Hospital-Associated Outbreak  
*Jae-Hoon Ko, Ji Yeon Lee, Jin Yang Baek, Hyeri Seok, Ga Eun Park, Ji Yong Lee, Sun Young Cho, Young Eun Ha, Cheol-In Kang, Ji-Man Kang, Yae-Jean Kim, Eun-Suk Kang, So Hyun Kim, Ik Joon Jo, Chi Ryang Chung, Myong-Joon Hahn, Marcel A. Müller, Christian Drosten, Doo Ryeon Chung, Jae-Hoon Song and Kyong Ran Peck*
- 239** Impact and Limitations of the 2015 National Health and Safety Network Case Definition on Catheter-Associated Urinary Tract Infection Rates  
*Ana Cecilia Bardossy, Rachna Jayaprakash, Anjali C. Alangaden, Patricia Starr, Odaliz Abreu-Lanfranco, Katherine Reyes, Marcus J. Zervos and George J. Alangaden*
- 242** Electronic *Clostridium difficile* Infection Bundle Reduces Time to Initiation of Contact Precautions  
*Courtney M. Dewart, Natalia Blanco, Betsy Foxman and Anurag N. Malani*

#### Research Briefs

- 245** Periumbilical Skin and Soft-Tissue Infections Resulting From a Newborn Tracking Device  
*Kenneth M. Zangwill, Alma D. Belis, Kimberly J. Ko and Janet M. Landholm*
- 247** Hepatitis C Post-Exposure Prophylaxis for Healthcare Personnel: Policy Analysis Among Philadelphia’s Large Teaching Institutions  
*Gina M. Simoncini and Amy B. Jessop*

#### Letters to the Editor

- 249** Do Patients Get Whacked When Hospitals Get HACed?  
*Leonard A. Mermel*
- 250** Postdischarge Surveillance: Value and Problems Perceived by Infection Control Practitioners in Switzerland  
*Giuseppe Santoro, Ernst Tabori, Andrea Rytz and Sebastian Schulz-Stübner*
- 251** Subjective Qualitative Hand Hygiene Compliance Observation: A Feasibility Trial  
*Janine Bierwirth and Sebastian Schulz-Stübner*
- 252** Emergence of OXA-72-producing *Acinetobacter baumannii* Belonging to High-Risk Clones (CC15 and CC79) in Different Brazilian States  
*Mariana Pagano, Lisiane Rocha, Jorge L. M. Sampaio, Andreza F. Martins and Afonso L. Barth*

- 254** A Silent Epidemic of Colistin- and Carbapenem-Resistant Enterobacteriaceae at a Turkish University Hospital  
*Gökhan Metan, Ahmet Ilbay, Ozgen Koseoglu Eser, Serhat Unal and Pinar Zarakolu*

#### Corrigendum

- 258** An Evaluation of Food as a Potential Source for *Clostridium difficile* Acquisition in Hospitalized Patients—CORRIGENDUM  
*Jennie H. Kwon, Cristina Lanzas, Kimberly A. Reske, Tiffany Hink, Sondra M. Seiler, Kerry M. Bommarito, Carey-Ann D. Burnham and Erik R. Dubberke*

# MICROBIAL SURVEILLANCE TESTING MADE EASY

*Healthmark offers the One-Two Punch to Identify and Document the Efficacy of Your Endoscope Reprocessing*

## SCREEN WITH THE **NOW! TEST**

*Rapid Indicator of  
Gram-Negative bacteria*



Immediate, practical screening test. Simply flush the lumen of a flexible endoscope, such as a duodenoscope, and follow the procedure for gram-negative bacteria detection in less than 12 hours.

**< 10 CFU**

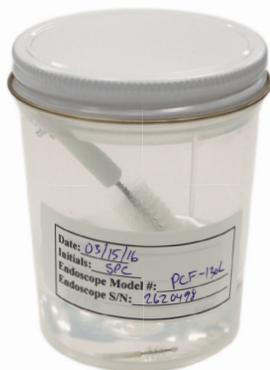


 **healthmark**

## AUDIT WITH THE

# FLEXIBLE ENDOSCOPE SAMPLING KIT

*Surveillance tool for the random testing of duodenoscopes in compliance with CDC guidelines - In association with Nelson Laboratories*



A simple and complete kit. After flushing and brushing the lumen and elevator mechanism of a duodenoscope, simply follow the procedure to have the sample solution & brush heads quickly sent to Nelson Laboratories - the leader in independent testing of flexible endoscopes. All tools are included for testing and shipment.

  
**NELSON**  
LABORATORIES

HEALTHMARK INDUSTRIES | WWW.HMARK.COM | 800.521.6224 | 33671 DOREKA DRIVE FRASER, MI 48026

*An Official Publication of the Society for Healthcare Epidemiology of America*

## EDITOR

Suzanne F. Bradley, MD • Ann Arbor, MI

## DEPUTY EDITOR

Carol Chenoweth, MD • Ann Arbor, MI

## SENIOR ASSOCIATE EDITORS

C. Glen Mayhall, MD • Galveston, TX  
Gina Pugliese, RN, MS • Chicago, IL  
William Schaffner, MD • Nashville, TN

## ASSOCIATE EDITORS

Lindsay E. Nicolle, MD • Winnipeg, Manitoba  
Trevor C. Van Schooneveld, MD • Omaha, NE  
David Weber, MD, MPH • Chapel Hill, NC

## STATISTICS CONSULTANTS

Jon P. Furuno, PhD • Portland, OR  
Jessina C. McGregor, PhD • Portland, OR

## MANAGING EDITOR

Gennifer Levey • New York, NY

## PAST EDITORS

### *Infection Control*

Richard P. Wenzel, MD, 1980-1987 (vols. 1-8)

### *Infection Control & Hospital Epidemiology*

Richard P. Wenzel, MD, 1988-1992

(vols. 9-13)

Michael D. Decker, MD, 1993-2001 (vols. 14-22)

Barry M. Farr, MD, 2002-2004 (vols. 23-25)

William R. Jarvis, MD, 2005-2006 (vols. 26 and 27)

## EDITORIAL ADVISORY BOARD

Deverick Anderson, MD, MPH • Durham, NC

Anucha Apisarnthanarak, MD • Pratumthani, Thailand

Lennox Archibald, MD, FRCP • Alachua, FL

Shailen Banerjee, PhD • Atlanta, GA

Elise M. Beltrami, MD, MPH • Atlanta, GA

Jo Anne Bennett, RN, PhD • New York, NY

David Birnbaum, PhD, MPH • Sidney, BC

Marc Bonten, MD • Utrecht, Netherlands

Christian Brun-Buisson, MD • Creteil, France

John P. Burke, MD • Salt Lake City, UT

David P. Calfee, MD, MS • New York, NY

Yehuda Carmeli, MD, MPH • Tel Aviv, Israel

Donald E. Craven, MD • Burlington, MA

Christopher Crnich, MD, MS • Madison, WI

Erika D'Agata, MD, MPH • Boston, MA

Daniel Diekema, MD • Iowa City, IA

Erik Dubberke, MD, MSPH • St. Louis, MO

Charles E. Edmiston, Jr., PhD • Milwaukee, WI

Mohamad Fakhri, MD, MPH • Grosse Pointe Woods, MI

Petra Gastmeier, MD • Berlin, Germany

Jeffrey Gerber, MD, PhD • Philadelphia, PA

Dale N. Gerding, MD • Hines, IL

Donald A. Goldmann, MD • Boston, MA

Nicholas Graves, PhD • Brisbane, Australia

Donna Haiduvén, RN, PhD, CIC • Tampa, FL

Anthony D. Harris, MD, MPH • Baltimore, MD

Elizabeth Henderson, PhD • Calgary, AB

David K. Henderson, MD • Bethesda, MD

Loreen A. Herwaldt, MD • Iowa City, IA

Peter N. R. Hensel, MD • Brea, CA

John A. Jernigan, MD, MS • Atlanta, GA

Mini Kamboj, MD • New York, NY

Carol A. Kauffman, MD • Ann Arbor, MI

James T. Lee, MD, PhD • St. Paul, MN

L. Clifford McDonald, MD • Atlanta, GA

Allison McGeer, MD • Toronto, ON

Leonard A. Mermel, DO, ScM • Providence, RI

Robert R. Muder, MD • Pittsburgh, PA

Linda Mundy, MD • Collegeville, PA

Joseph M. Mylotte, MD, CIC • Buffalo, NY

Jan Evans Patterson, MD • San Antonio, TX

David A. Pegues, MD • Philadelphia, PA

Didier Pittet, MD, MS • Geneva, Switzerland

Isaam Raad, MD • Houston, TX

Manfred L. Rotter, MD, DipBact • Vienna, Austria

William A. Rutala, PhD, MPH • Chapel Hill, NC

Lisa Saiman, MD, MPH • New York, NY

Sanjay Saint, MD, MPH • Ann Arbor, MI

Sorana Segal-Maurer, MD • Flushing, NY

Lynne M. Sehulster, PhD • Atlanta, GA

John A. Sellick, DO • Amherst, NY

Andrew E. Simor, MD • Toronto, ON

Philip W. Smith, MD • Omaha, NE

Kurt Stevenson, MD, MPH • Columbus, OH

Nimalie Stone, MD • Atlanta, GA

Thomas Talbot, MD, MPH • Nashville, TN

Paul Tambyah, MBBS • Singapore

William Trick, MD • Chicago, IL

Antoni Trilla, MD, PhD • Barcelona, Spain

Robert A. Weinstein, MD • Chicago, IL

Andreas Widmer, MD, MS • Basel, Switzerland

Marcus Zervos, MD • Detroit, MI

*Infection Control & Hospital Epidemiology* (ISSN 0899-823X) is published monthly by Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA.

## Editorial Office

Communications should be addressed to the Editor, *Infection Control & Hospital Epidemiology*, One Liberty Plaza, New York, NY 10006 (email: [iche.managingeditor@cambridge.org](mailto:iche.managingeditor@cambridge.org)). Contributors should consult the Instructions for Contributors, which is available at the journal's Web site.

## Advertising

Please direct advertising inquiries to M. J. Mrvica Associates, 2 West Taunton Avenue, Berlin, NJ 08009 (e-mail: [mjmrvica@mrvica.com](mailto:mjmrvica@mrvica.com); telephone: 856-768-9360, fax: 856-753-0064). Publication of an advertisement in *Infection Control & Hospital Epidemiology* does not imply endorsement of its claims by the Society for Healthcare Epidemiology of America, by the Editor, or by Cambridge University Press.

## Permissions

Articles may be copied or otherwise reused without permission only to the extent permitted by Sections 107 and 108 of the US Copyright Law. Permission to copy articles for personal, internal, classroom, or library use may

be obtained from the Copyright Clearance Center (<http://www.copyright.com>, email: [info@copyright.com](mailto:info@copyright.com)). For all other uses, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, please contact Cambridge University Press. Full details may be found at: [www.cambridge.org/about-us/rights-permissions](http://www.cambridge.org/about-us/rights-permissions).

## Subscriptions

The individual subscription rate for 2017 is \$247. Individuals have the option to order directly from Cambridge University Press. Institutional print + electronic and e-only subscriptions are available from Cambridge University Press and include unlimited online access; rates are tiered according to an institution's type and research output and may be reviewed at the journal's CJO homepage: [cambridge.org/ICHE](http://cambridge.org/ICHE).

Please direct subscription inquiries and requests for back issues to Customer Services at Cambridge University Press, e-mail: [subscriptions\\_newyork@cambridge.org](mailto:subscriptions_newyork@cambridge.org) (USA, Canada, and Mexico) or [journals@cambridge.org](mailto:journals@cambridge.org) (outside of USA, Canada, and Mexico).

**Postmaster:** Send address changes to *Infection Control & Hospital Epidemiology*, Cambridge University Press, One Liberty Plaza, New York, NY 10006 USA.

## About the cover:



The cover format of each volume of *Infection Control & Hospital Epidemiology* honors one of the many professionals throughout history who recognized not only how disease might be spread but also how the principles of epidemiology could be applied to reduce healthcare-associated infections.

Joseph Lister (1827–1912) was born to a Quaker family in the outskirts of London. His father, Joseph Jackson Lister, worked as a wine merchant by day and pursued the study of optics as a hobby. His work helped found modern microscopy, for which he was elected to the Royal Academy in 1832.

Young Lister decided to become a surgeon at an early age. Due to his religious affiliation, Lister was barred from attending older universities of greater prestige and settled upon study at the University of London, from which he received his medical degree and Fellowship in the Royal Academy of Surgeons. Lister moved to Edinburgh in 1853 to work under Mr. Syme, one of the preeminent British surgeons of the day. In Edinburgh, Lister made important observations on the pathogenesis of inflammation. He also gained a wife, Syme's daughter, Agnes, but in doing so had to become a member of the Church of England. Agnes worked closely beside Lister for many years, recording his experiments in great detail.

By 1856, Lister assumed professorship in surgery at the University of Glasgow, where he began to develop his principles of antiseptic surgery. At the time, surgical mortality rates from sepsis ranged from 23% to 60%, and it was assumed that putrefaction and purulent infection of wounds originated from tainted air. Based on the work of his colleague, Louis Pasteur, Lister performed a series of meticulous experiments in which he used antiseptics and developed optimal wound dressing techniques that focused on keeping wounds clean rather than excluding air. Lister traveled widely in the United Kingdom, Europe, and the United States promoting his wound-care techniques. He returned briefly to Edinburgh before assuming the Chair of Clinical Surgery at King's College in London. In 1891, Lister became a Founder of the British Institute for Preventive Medicine, the first academic medical research institute in the United Kingdom. He served as the Institute's President, and the organization was ultimately renamed in his honor. Lister served as President of the Royal Society of London and was appointed to the House of Lords. After his death, Lord Lister chose not to be buried in Westminster Abbey but rather was laid to rest next to his wife.

---

**Cover image: Detail of Lister Introduces Antisepsis, from “The History of Medicine” by Robert Thom, used with permission from University of Michigan Museum of Art.**