

# Infection Control Hospital Epidemiology

Volume 40, No 8



**AUGUST 2019** 



## Medicine

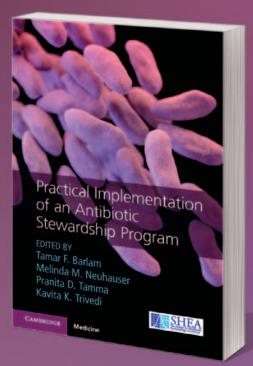
# Practical Implementation of an Antibiotic Stewardship Program

#### Editors:

Tamar F.Barlam, *Boston Medical Center* Melinda M. Neuhauser, *Department of Veteran Affairs* 

Pranita D. Tamma, *The Johns Hopkins University School of Medicin*e

Kavita K. Trivedi, *Trivedi Consults*, *LLC.* 



June 2018 / Hardback / 9781107166172 \$64.99 / £49.99 Practical Implementation of an Antibiotic Stewardship Program provides an essential resource for healthcare providers in acute care, long-term care, and ambulatory care settings looking either to begin or to strengthen existing antibiotic stewardship programs. Each chapter is written by both physician and pharmacist leaders in the stewardship field and incorporates both practical knowledge as well as evidence-based guidance. This book will also serve as a useful resource for medical students, pharmacy students, residents, and infectious diseases fellows looking to learn more about the field of antibiotic stewardship.

- Presents a practical guide for the implementation of antibiotic stewardship programs
- Offers real-life experience from experts in developing and sustaining antibiotic stewardship programs
- Incorporates both practical experience and evidence-based guidance to implement effective antibiotic stewardship programs in the acute care, long-term care, and ambulatory care settings

For more information, please go to cambridge.org/antibioticstewardshipprogram



Volume 40 2019 Number 8

#### **CONTENTS**

#### **Original Articles**

- 839 Creating reasonable antibiograms for antibiotic stewardship programs in nursing homes: Analysis of 260 facilities in a large geographic region, 2016–2017

  Scott K. Fridkin, Jacob Pack, Giancarlo Licitra, Ziduo Zheng, Russell Watkins, Steve Price, Mayfield Camp and Renee Moore
- 847 Total duration of antimicrobial therapy resulting from inpatient hospitalization April P. Dyer, Elizabeth Dodds Ashley, Deverick J. Anderson, Christina Sarubbi, Rebekah Wrenn, Lauri A. Hicks, Arjun Srinivasan and Rebekah W. Moehring
- 855 Real-world effectiveness of infection prevention interventions for reducing procedure-related cardiac device infections: Insights from the veterans affairs clinical assessment reporting and tracking program

  Archana Asundi, Maggie Stanislawski, Payal Mehta, Anna E. Baron, Hillary J. Mull, P. Michael Ho, Peter J. Zimetbaum, Kalpana Gupta and Westyn Branch-Elliman
- 863 Healthcare-associated urinary tract infections with onset post hospital discharge Miriam R. Elman, Craig D. Williams, David T. Bearden, John M. Townes, John D. Heintzman, Jodi A. Lapidus, Ravina Kullar, Sheila Markwardt, Amanda T. Trieu, Arrash A. Vahidi and Jessina C. McGregor
- 872 Reduction in *Clostridium difficile* infection rates following a multifacility prevention initiative in Orange County, California: A controlled interrupted time series evaluation *Kyle R. Rizzo, Sarah H. Yi, Erin P. Garcia, Matt Zahn and Erin Epson*
- 880 Implementation of a *Clostridioides difficile* prevention bundle: Understanding common, unique, and conflicting work system barriers and facilitators for subprocess design *Jackson S. Musuuza, Ann Schoofs Hundt, Pascale Carayon, Karly Christensen, Caitlyn Ngam, Nicholas Haun and Nasia Safdar*
- 889 Which healthcare workers work with acute respiratory illness? Evidence from Canadian acute-care hospitals during 4 influenza seasons: 2010–2011 to 2013–2014

  Lili Jiang, Allison McGeer, Shelly McNeil, Kevin Katz, Mark Loeb, Matthew P. Muller, Andrew Simor, Jeff Powis, Philipp Kohler, Julia M. Di Bella and Brenda L. Coleman for the Canadian Healthcare Worker Study Group
- 897 The impact of incorporating early rapid influenza diagnosis on hospital occupancy and hospital acquired influenza

  Lior Nesher, Gal Tsaban, Jacob Dreiher, Kenneth V.I. Rolston, Gal Ifergane, Yonat Shemer, Abraham Borer and Klaris Riesenberg

#### Reviews

904 Persisting intrahospital transmission of multidrug-resistant *Klebsiella pneumoniae* and challenges for infection control Isabelle Vock and Sarah Tschudin-Sutter

910 Analysis of multisite intervention studies using generalized linear mixed models *Nicole M. White and Adrian G. Barnett* 

#### Commentary

918 Averting a betrayal of trust: System and individual accountability in healthcare infection prevention *Gonzalo M. Bearman and Rebecca A. Vokes* 

#### Concise Communication

- 920 Antimicrobial utilization data: Does point prevalence data correlate with defined daily doses? Stephen B. Lee, Daniel J.G. Thirion, Neal Irfan, Melani Sung, Annie Brooks, Fatimah Al-Mutawa, Charles Frenette and Dominik Mertz
- 922 Oral antibiotics prior to colorectal surgery: Do they have to be combined with mechanical bowel preparation? *Tessa Mulder and Jan A.J.W. Kluytmans*
- 928 Attributable mortality due to fluoroquinolone and extended-spectrum cephalosporin resistance in hospital-onset *Escherichia coli* and *Klebsiella* spp bacteremia: A matched cohort study in 129 Veterans Health Administration medical centers

  Hiroyuki Suzuki, Eli N. Perencevich, Daniel J. Livorsi, Bruce Alexander, Brice F. Beck, Kelly K. Richardson and Michihiko Goto
- 932 Improved mortality in *Staphylococcus aureus* bacteremia with the involvement of antimicrobial stewardship team and infectious disease consultation

  Jacqueline E. Sherbuk, Dayna McManus, Jeffrey E. Topal and Maricar Malinis
- 936 Management of carbapenemase-producing *Enterobacteriaceae* in a low incidence area: A six-year experience in a university hospital

  Audrey Emery, Audrey Jeanvoine, Pascale Bailly, Houssein Gbaguidi-Haore, Didier Hocquet and Xavier Bertrand
- 939 Droplet precautions on site instead of single room isolation for respiratory tract infections
  Rami Sommerstein, Tiago Castro Lopes Azevedo, Christina Aerschmann, Fabienne Hobi, Martin Egger and
  Jonas Marschall
- 943 Cognitive bias in professional hand hygiene and feedback: A national online-survey on overconfidence in Germany
  Stefan Bushuven, Marc Weidenbusch, Stefan Mohr, Achilles Delis, Martin R. Fischer, Jana Juenger and
  Markus Dettenkofer

### Letters to the Editor

	Letters to the Luttor
947	Smarter cleaning is safer for health Elizabeth E. Gillespie
948	What works for engaging lay stakeholders: Advice from a patient and caregiver group Betty L. Kaiser, Gay R. Thomas, Julie A. Keating, Nicole Brys, Mary Jo Knobloch and Nasia Safdar
949	Current status of infection control professionals in a Chinese city Peijin Zhang and Liling Tang
951	Requirement of hollow process challenge device for monitoring hollow and complex instruments sterilization: a simulator for proper sterility assurance Debabrata Basu
952	Serotype 14 pneumococcal bacteremia: From one neonate to another in a pediatric intensive care unit Audrey Vincent, Stéphane Bonacorsi, Emmanuelle Varon, Stéphane Dauger and Michael Levy
954	Equal, but different: Fluctuant biofilm formation and its impact on polymyxin B susceptibility among a clonal spreading of KPC-2–producing <i>Klebsiella pneumoniae</i> isolates <i>Leandro Reus Rodrigues Perez</i>
955	Prevalence of bloodstream infections in neutropenic patients with bacteriuria Erica S. Herc, Rachelle N. Rivera, Dale Bixby and Carol E. Chenoweth
957	The impact of efflux pumps on meropenem susceptibility among metallo- $\beta$ -lactamase-producing and nonproducing <i>Pseudomonas aeruginosa</i> : Insights for better antimicrobial stewardship <i>Leandro Reus Rodrigues Perez</i>
958	Forecasting from phenotypic testing to an antimicrobial stewardship strategy: Does the time to positivity of a blue-carba test predict the meropenem susceptibility level among carbapenemase producers? Leandro Reus Rodrigues Perez
	Corrigendum

Changes in outpatient antibiotic utilization, 2000–2016: More people are receiving fewer antibiotics — CORRIGENDUM

961

## MICROBIAL SURVEILLANCE TESTING MADE EASY

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



**AUDIT WITH THE** 

## FLEXIBLE ENDOSCOPE SAMPLING KIT

Surveillance tool for the random testing of duodenoscopes in compliance with CDC quidelines - 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.

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

#### cambridge.org/ICHE

An Official Publication of the Society for Healthcare Epidemiology of America

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

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

Lindsay MadMurray • New York, NY

Infection Control • Portland, OR 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- Carol A. Kauffman, MD • Ann Arbor, MI 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 Fakih, 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 Haiduven, 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. Heseltine, MD • Brea, CA John A. Jernigan, MD, MS • Atlanta, GA

Mini Kamboj, MD • New York, NY

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. 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; 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). 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.

#### **Subscriptions**

The individual subscription rate for 2019 is \$273. 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.

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



Since 2015, the cover format of each volume of *Infection Control and Hospital Epidemiology* has been c1hanged to honor one of the many professionals through out history who recognized not only how disease might be spread but also how those principles could be applied to reduce health care associated infections.

Rabbi Moshe ben Maimon or Moses Maimonides (son of Maimon) was born in Cordoba, Spain, a center of intellectual and religious freedom, on March 30, circa 1135. Maimon ben Joseph, his father, was a prominent scholar, writer, and judge for Jewish religious courts. Maimonidesstudied with Averroes, aprominent physician-philosopher. In 1148, his family left Cordoba after a repressive dynasty, the Almohades Caliphate that ruled in Spain and North Africa during the 12th and 13th centuries, required that they either convert to Islam, emigrate, or be put to death. They wandered first to Fez, Morocco, and to Acco, Palestine, before finally settling in Old Cairo (Fostat), Egypt, circa 1165. His father and brother established a business selling precious stones, but soon after, his father died and his brother David perished in a shipwreck. Maimonides turned to medicine as a means to support both families. While only in

his thirties, Maimonides was appointed as physician to the Court of the Sultan, and he served as head of the Jewish community in Cairo. During the Crusades, Maimonides' reputation as a healer was so great that King Richard the Lion hearted offered him a position as his personal physician.

Maimonides wrote many scholarly works on a variety of subjects ranging from biblical and Talmudic law to logic, science, and medicine. He embraced the use of careful scientific reasoning and eschewed mysticism. In his 10 books on medicine, Maimonides was an early advocate for the importance of hygiene, bathing, and the need for fresh air, clean water, a healthy diet, as well as proper disposal of refuse and placement of toilets far away from living quarters. Maimonides was an early "steward" who recommended non pharmacological interventions first. He also noted where evidence was lacking and further investigation was needed before recommendations could be made. Many of the concerns and observations that Maimonides made more than 800 years ago remain highly relevant to the field of infection prevention and control today.

Maimonides died in Cairo on December 13, 1204 at the age of 69. Several legends are a scribed to Maimonides. It is unlikely that he wrote the Oathor Prayer of Maimonides. He is buried in Tiberias, Palestine, on the western shore of the Sea of Galilee in present-day Israel. However, this site was not chosen at random by a donkey that roamed free while bearing his body; Maimonides was interred at Tiberias at his request. Even today, Maimonides remains a highly regarded physician, philosopher, and scholar among Jewish, Arabic, and Christiancircles.

Cover image: Statue of the Jewish scholar Moses Maimonides, Rabbi Mosheh Ben Maimon, Cordoba, Andalusia, Spain - courtesy of Shutterstock.





#### **TEEZyme®** Enzymatic Sponges

TEEZyme super absorbent sponges are designed to hold enzymatic detergent in, so that the detergent is guaranteed to disperse over the probe surface and is distributed more evenly. This provides longer contact time with biofilm and contaminants allowing the detergent to break them down.

- TEEZyme enzymatic sponges aid in the solubilization of polysaccharides and removal of biofilm allowing for high-level disinfectants to kill microbes
- TEEZyme enzymatic sponges have a proprietary blend of enzymes designed to break down all bio burden — blood, carbohydrates, protein, polysaccharides, fats, oils, uric acid and other nitrogenous compounds
- TEEZyme enzymatic sponges are lint-free, latex-free and dust-free

#### QwikDry® TEE Probe Drying Cloths

QwikDry TEE probe drying cloths have been developed to give healthcare professionals the added confidence of properly dried ultrasound TEE probes prior to re-use or storage. The super absorbent pad effectively removes moisture from TEE ultrasound probes without damaging the probe or sticking to the ultrasound probe during the drying process.

- · Non-abrasive surface for easy glide on TEE probe
- · Individually packaged, irradiated cloth
- · Engineered textile with internal highly absorbent membrane

#### **TPorter® Transportation System**

TPorter TEE Ultrasound Probe Transportation and Procedure Case is designed to effectively and securely move high-level disinfected TEE ultrasound probes to the procedure area and then return the biologically soiled TEE ultrasound probe for reprocessing. TPorter features a variety of molded compartments to accommodate the TEE ultrasound probe, bite block(s), a PullUp™ Bio-Barrier Sleeve and

- a TEEZyme enzymatic sponge.
- · Constructed of polycarbonate for excellent visibility and strength
- Individual compartments for electrical connector, cables and insertion tube
- Individual compartment for transportation of pre- and post-care items
- · Designed to transport all major TEE probe brands



2179 East Lyon Station Road • Creedmoor, NC 27522 Toll Free: 877.255.9472 • Phone: 919.255.9472 www.csmedicalllc.com • info@csmedicalllc.com

# Medicine

Books and Journals from Cambridge University Press

The Cambridge Medicine programme focuses its book publishing in a defined set of core clinical areas with our great strength in the clinical brain sciences. Other specialties of significant focus include reproductive medicine/obstetrics and gynaecology, anaesthesia and critical care, emergency medicine and pathology.

Our journals programme covers a broad spectrum of medical disciplines including emergency and disaster medicine, epidemiology and infectious diseases, biomedical science, genetics, nutrition, mental health and psychiatry, and neuroscience.

We partner with many learned societies including The Society for Healthcare Epidemiology of America, and the Neuroscience Education Institute, and the Royal College of Obstetricians and Gynaecologists.

For further details visit: cambridge.org/core-medicine

Cambridge **Core** 

