

Volume 40, No 2

ICHE

FEBRUARY 2019

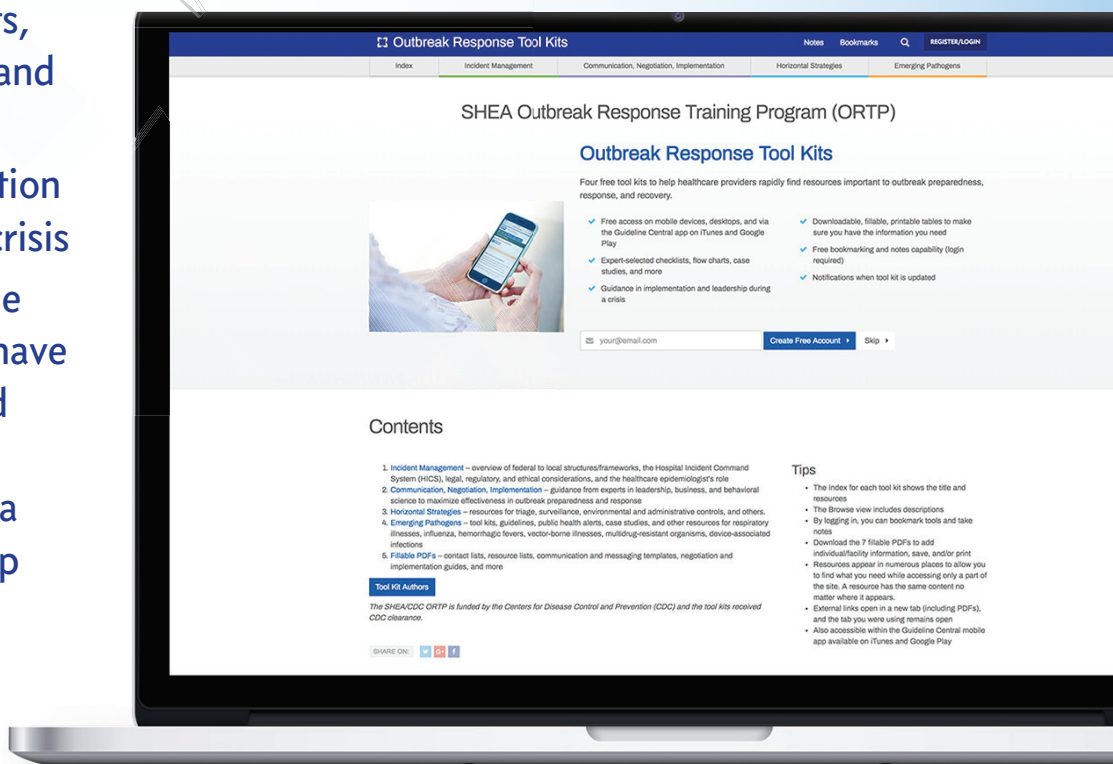


MAIMONIDES

OUTBREAK RESPONSE TOOL KITS

The SHEA/CDC Outbreak Response Training Program (ORTP) tool kits are your source for quick, concise information and resources to help you and your facility effectively manage outbreaks.

- Expert-selected checklists, flow charts, summaries, and diagrams
- Guidance in implementation and leadership during a crisis
- Downloadable and fillable tables to make sure you have the information you need
- Free access on mobile devices, desktops, and via the Guideline Central app
- And more...



View the tool kits online
ORTP.GuidelineCentral.com

CONTENTS

Original Articles

- 125** The return of investment of hospital-based surgical quality improvement programs in reducing surgical site infection at a Canadian tertiary-care hospital
Sasha van Katwyk, Kednapa Thavorn, Doug Coyle, Husein Moloo, Alan J. Forster, Timothy Jackson and David Schramm
- 133** Is the efficacy of antibiotic prophylaxis for surgical procedures decreasing? Systematic review and meta-analysis of randomized control trials
Sumanth Gandra, Anna Trett, Gerardo Alvarez-Uria, Joseph S. Solomkin and Ramanan Laxminarayan
- 142** Cefazolin as surgical antimicrobial prophylaxis in hysterectomy: A systematic review and meta-analysis of randomized controlled trials
Aurora Pop-Vicas, Stephen Johnson and Nasia Safdar
- 150** Infections after pediatric ambulatory surgery: Incidence and risk factors
Jeffrey S. Gerber, Rachael K. Ross, Julia E. Szymczak, Rui Xiao, A. Russell Localio, Robert W. Grundmeier, Susan L Rettig, Eva Teszner, Doug A. Canning and Susan E. Coffin
- 158** A comparison of the efficacy of multiple ultraviolet light room decontamination devices in a radiology procedure room
Jennifer L. Cadnum, Annette L. Jencson, Scott A. Gestrich, Scott H. Livingston, Boris A. Karaman, Kevin J. Benner, Brigid M. Wilson and Curtis J. Donskey
- 164** Effectiveness of antimicrobial hospital curtains on reducing bacterial contamination—A multicenter study
Shik Luk, Viola Chi Ying Chow, Kelvin Chung Ho Yu, Enoch Know Hsu, Ngai Chong Tsang, Vivien Wai Man Chuang, Christopher Koon Chi Lai, Mamie Hui, Rodney Allan Lee, Wai Man Lai, Tak Lun Que, Sau Chun Fung, Wing Kin To, Vincent Chi Chung Cheng and Andrew Tin Yau Wong
- 171** Molecular analysis of bacterial contamination on stethoscopes in an intensive care unit
Vincent R. Knecht, John E. McGinniss, Hari M. Shankar, Erik L. Clarke, Brendan J. Kelly, Ize Imai, Ayannah S. Fitzgerald, Kyle Bittinger, Frederic D. Bushman and Ronald G. Collman
- 178** Human factors-based risk analysis to improve the safety of doffing enhanced personal protective equipment
Ayse P. Gurses, Aaron S. Dietz, Elaine Nowakowski, Jennifer Andonian, Maggie Schiffhauer, Carrie Billman, Anya M. Abashian, Polly Trexler, Patience Osei, Lauren E. Benishek, Anping Xie, Peter Pronovost, Michael A. Rosen, Lisa L. Maragakis for the CDC Prevention Epicenter Program

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

187 A multimodal regional intervention strategy framed as friendly competition to improve hand hygiene compliance
Manon D. van Dijk, Sanne A. Mulder, Vicki Erasmus, A. H. Elise van Beeck, Joke M. J. J. Vermeeren, Xiaona Liu, Ed F. van Beeck and Margreet C. Vos

194 Patient isolation for infection control and patient experience
Zishan K. Siddiqui, Sarah Johnson Conway, Mohammed Abusamaan, Amanda Bertram, Stephen A. Berry, Lisa Allen, Ariella Apfel, Holley Farley, Junya Zhu, Albert W. Wu and Daniel J. Brotman

Review

200 All aboard!: Involvement of medical and pharmacy trainees in antimicrobial stewardship
Lindsey M. Childs-Kean, Heather L. Briggs and Jonathan C. Cho

Commentary

206 It is time to define antimicrobial never events
Jiajun Liu, Keith S. Kaye, Nicholas J. Mercurio, Susan L. Davis, Twisha S. Patel, Lindsay A. Petty, Gwendolyn M. Pais and Marc H. Scheetz

Concise Communications

208 Comparison of hospital surgical site infection rates and rankings using claims versus National Healthcare Safety Network surveillance data
Chanu Rhee, Rui Wang, Maximilian S. Jentzsch, Carly Broadwell, Heather Hsu, Robert Jin, Kelly Horan and Grace M. Lee

211 Surgical site infections following hip and knee arthroplastic surgery: Trends and risk factors of *Staphylococcus aureus* infections
Jana Prattergerová, Emmi Sarvikivi, Kaisa Huotari, Jukka Ollgren and Outi Lyytikäinen

214 Sharing is not always a good thing: Use of a DNA marker to investigate the potential for ward-to-ward dissemination of healthcare-associated pathogens
Heba Alhmidi, Jennifer L. Cadnum, Annette L. Jencson, Ali Abdulfatah Gweder and Curtis J. Donskey

217 A metallo-beta-lactamase producing Enterobacteriaceae outbreak from a contaminated tea dispenser at a children's hospital in Japan
Kenta Ito, Hitoshi Honda, Makiko Yoshida, Kotaro Aoki, Yoshikazu Ishii, Shigeko Miyokawa and Yuho Horikoshi

221 One-day point prevalence as a method for estimating antibiotic use in nursing homes
Grant R. Barney, Christina B. Felsen and Ghinwa K. Dumyati

224 Point-prevalence study of antimicrobial use in public hospitals in southern Sri Lanka identifies opportunities for improving prescribing practices
Tianchen Sheng, Gaya B. Wijayarathne, Thushani M. Dabrera, Richard J. Drew, Ajith Nagahawatte, Champica K. Bodinayake, Ruvini Kurukulasooriya, Truls Østbye, Kristin J. Nagaro, Cherin De Silva, Hasini Ranawakaarachchi, A. T. Sudarshana, Deverick J. Anderson, Christopher W. Woods and L. Gayani Tillekeratne

- 228** Use of diagnostic stewardship practices to improve urine culturing among SHEA Research Network hospitals
Kaede V. Sullivan, Daniel J. Morgan and Surbhi Leekha
- 232** How well do N95 respirators protect healthcare providers against aerosolized influenza virus?
Werner E. Bischoff, JoLyn Turner, Gregory Russell, Maria Blevins, Engy Missaiel and John Stehle
- 235** Incidence and etiology of fever following seasonal influenza vaccination in hospitalized patients
Kap Sum Foong, Ed Casabar and David K. Warren
- 238** Aerosol transmission of severe fever with thrombocytopenia syndrome virus during resuscitation
Jaeyoung Moon, Hyeokjin Lee, Ji Hoon Jeon, Yejin Kwon, Hojin Kim, Eun Byeol Wang, Choong Won Seo, Sul A. Sung, Su-Hyun Kim, Hyeri Seok, Won Suk Choi, WooYoung Choi and Dae Won Park

Research Briefs

- 242** Cost Analysis of Computerized Clinical Decision Support and Trainee Financial Incentive for *Clostridioides difficile* Testing
Gregory R. Madden, Heather L. Cox, Melinda D. Poulter, Jason A. Lyman, Kyle B. Enfield and Costi D. Sifri
- 245** Molecular and epidemiologic investigation of a rhinovirus outbreak in a neonatal intensive care unit
Kenza Rahmouni El Idrissi, Sandra Isabel, Julie Carbonneau, Martine Lafond, Caroline Quach, Chelsea Caya, Patricia S. Fontela, Marc Beltempo, Guy Boivin, Marie-Astrid Lefebvre and Jesse Papenburg
- 248** Route of administration for antibiotics with high oral bioavailability
Michael J. Smith, Cary Thurm, Samir S. Shah, Sameer J. Patel, Matthew P. Kronman, Jeffrey S. Gerber, Joshua D. Courter, Brian R. Lee, Jason G. Newland and Adam L. Hersh

Letter to the Editor

- 250** Are reusable blood collection tube holders the culprit for nosocomial hepatitis C virus transmission?
Dominic N. C. Tsang, Margaret Ip, Paul K. S. Chan, Patricia Tai Yin Ching, Hung Suet Lam and Wing Hong Seto

Letter in Reply

- 252** Reusable blood collection tube holders are implicated in nosocomial hepatitis C virus transmission
Vincent C. C. Cheng, Shuk-Ching Wong, Sally C. Y. Wong, Siddharth Sridhar, Cyril C. Y. Yip, Jonathan H. K. Chen, James Fung, Kelvin H. Y. Chiu, Pak-Leung Ho, Sirong Chen, Ben W. C. Cheng, Chi-Lai Ho, Chung-Mau Lo and Kwok-Yung Yuen

Letters to the Editor

- 254** Use of a stop valve to enhance disinfectant exposure may improve sink drain disinfection
Jennifer L. Cadnum, Scott H. Livingston, Scott A. Gestrich, Annette L. Jencson, Brigid M. Wilson and Curtis J. Donskey

- 256** A novel color additive for bleach wipes indicates surface coverage and contact time to improve thoroughness of cleaning
Kevin Tyan, Katherine Jin and Jason Kang
- 258** A regional collaboration between competing healthcare systems to establish influenza season parameters
David H. Priest, Susan L. DeCamp-Freeze, Cynthia B. Snider, Melissa G. Morgan, Misty D. Garner, Laurence B. Givner, Catherine L. Passaretti and Andrea B. McQuaigue
- 260** Impact of expanded influenza post-exposure prophylaxis on healthcare worker absenteeism at a tertiary care center during the 2017–2018 season
Mireia Puig-Asensio, Margaret Douglas, Stephanie Holley, Mary E. Kukla, Oluchi Abosi, Lisa Mascardo, Brenda Carmody, Courtney Gent, Daniel J. Diekema, Patrick Hartley, Michael B. Edmond and Jorge L. Salinas
- 261** Establishing a mass prophylaxis clinic during a hospital scabies outbreak
Caitlin M. Adams Barker, M. James Alexander and Antonia L. Altomare
- 263** Low prevalence of the *mcr-1* gene among carbapenemase-producing clinical isolates of *Enterobacteriales*
Tanise Vendruscolo Dalmolin, Priscila Lamb Wink, Daiana de Lima-Morales and Afonso Luís Barth
- 265** Detecting *Clostridium difficile* outbreaks with ward-specific cut-off levels based on the Poisson distribution
Jon E. Edman-Wallér and Maria Werner

Addendum

- 267** Antiseptic effect of conventional povidone–iodine scrub, chlorhexidine scrub, and waterless hand rub in a surgical room: a randomized controlled trial—ADDENDUM
Jui-Chen Tsai, Yen-Kuang Lin, Yen-Jung Huang, El-Wui Loh, Hsiao-Yun Wen, Chia-Hui Wang, Yin-Tai Tsai, Wen-Shyang Hsieh and Ka-Wai Tam

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.

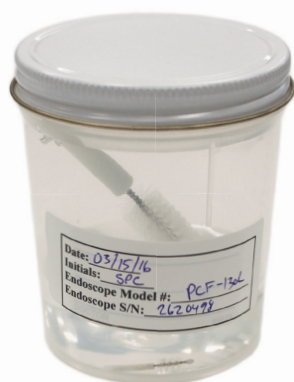
< 10 CFU



 **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

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 MacMurray • 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 Haiduvan, 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

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. Schulster, 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 changed to honor one of the many professionals throughout history who recognized not only how disease might be spread but also how those principles could be applied to reduce healthcare 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. Maimonides studied with Averroes, a prominent 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 Lionhearted 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 nonpharmacological 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 ascribed to Maimonides. It is unlikely that he wrote the Oath or 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 Christian circles.

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

Infectious Disease Physician Hospital Epidemiologist

The Division of Infectious Diseases at Mayo Clinic, Jacksonville, Florida invites applications for a position in clinical infectious disease and hospital epidemiology.

Mayo Clinic is seeking a board certified academic infectious disease physician who is trained in hospital epidemiology and infection prevention and control. Qualified candidates are required to have Infectious Diseases fellowship training and be Board Certified/Board Eligible in Infectious Diseases.

Evidence of academic productivity and commitment to research and education in infectious disease and hospital epidemiology is expected. The position will include an academic appointment with the Mayo Clinic College of Medicine. The division supports an ACGME-accredited fellowship in general infectious diseases.

Our group practice focuses on providing high quality, compassionate medical care. We are the largest integrated, not-for-profit medical group practice in the world with approximately 3,800 physicians and scientists across all locations. This unique working environment brings together the best in patient care, groundbreaking research and innovative medical education. We offer a highly competitive compensation package, which includes exceptional benefits, and we have been recognized by *FORTUNE* magazine as one of the top 100 “Best Companies to Work For”.

Please visit [Mayocareers.com/ICHEHE](https://www.mayocareers.com/ICHEHE) to apply online and learn more about Mayo Clinic and the vast array of opportunities that await you.

*Heal the sick,
Advance the science,
Share the knowledge.*



©2018 Mayo Foundation for Medical Education and Research. Post offer/pre-employment drug screening is required. Mayo Clinic is an equal opportunity educator and employer (including veterans and persons with disabilities).