#### The Official Journal of The Society for Healthcare Epidemiology of America

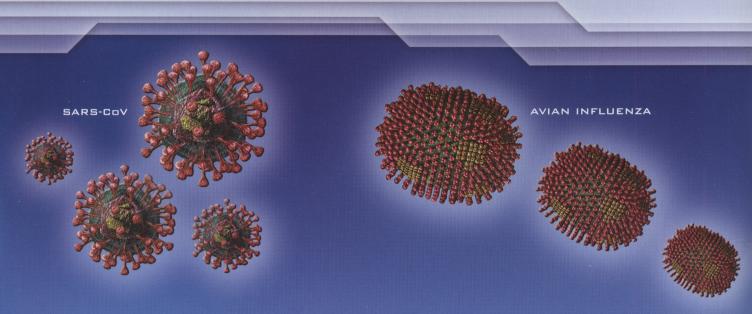
PUBLISHED FOR THE SOCIETY BY SLACK INCORPORATED

# INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY®

#### EDITORIAL

Facilities	
Suzanne F. Bradley, MD	227
DRIGINAL ARTICLES	
Standardized Infection Surveillance in Long-Term Care: Interfacility Comparisons From a Regional Cohort of Facilities	
KURT B. STEVENSON, MD, MPH; JAMES MOORE, MS; HOLLY COLWELL, RHIT, CCS; BARBARA SLEEPER, RN, C, BSN	231
Persistence of Fluoroquinolone-Resistant, Multidrug-Resistant Streptococcus pneumoniae in a Long-Term-Care Facility: Efforts to Reduce Intrafacility Transmission	
ALICIA M. FRY, MD, MPH; CHI CHI N. UDEAGU, MPH; MONTSE SORIANO-GABARRO, MD, MSC; SCOTT FRIDKIN, MD; DIANA MUSINSKI, RN; LESLIE LACLAIRE, MS; JOHN ELLIOTT, PHD; DEBRA J. P. COOK, MS; JOHN KORNBLUM, PHD; MARCELLE LAYTON, MD; CYNTHIA G. WHITNEY, MD, MPH	239
Failure to Control an Outbreak of Multidrug-Resistant <i>Streptococcus pneumoniae</i> in a Long-Term–Care Facility: Emergence and Ongoing Transmission of a Fluoroquinolone-Resistant Strain	
Rosalind J. Carter, PhD; Genevieve Sorenson, RN; Richard Heffernan, MPH; Julia A. Kiehlbauch, PhD; John S. Kornblum, PhD; Robert J. Leggiadro, MD; Lucia J. Nixon, MD; William A. Wertheim, MD; Cynthia G. Whitney, MD; Marcelle Layton, MD; the MDRSP Working Group	248
A Norovirus Gastroenteritis Epidemic in a Long-Term–Care Facility ELIZABETH COOPER, BN, MPUBHLTH (MELB); STEPHEN BLAMEY, MBBS, FRACS	256
An Outbreak of Norovirus Infection in a Long-Term-Care Unit in Spain Gemma Navarro, PhD; Rosa M. Sala, MD; Ferran Segura, PhD; César Arias, MD; Esperanza Anton, MD; Pilar Varela, MD; Pilar Peña, MD; Teresa Llovet, PhD; Isabel Sanfeliu; Maria Canals, RN; Guadalupe Serrate, MD; Antonio Nogueras, MD	259
Impact of an Outbreak of Norovirus Infection on Hospital Resources Walter Zingg, MD; Carlo Colombo, RN, MPH; Thomas Jucker, RN; Walter Bossart, PhD; Christian Ruef, MD	263
Evaluation of the Impact of the Source (Patient Versus Staff) on Nosocomial	
Norovirus Outbreak Severity Frauke Mattner, MD; Lutz Mattner, PhD; Hans Ulrich Borck, MD; Petra Gastmeier, MD	268
A Large Outbreak of <i>Clostridium difficile</i> -Associated Disease With an Unexpected Proportion of Deaths and Colectomies at a Teaching Hospital Following Increased Fluoroquinolone Use	
CARLENE A. MUTO, MD, MS; MARIAN POKRYWKA, MPH, BS, CIC; KATHLEEN SHUTT, MS; AARON B. MENDELSOHN, PHD; KATHY NOURI, MPH, RN, BSN, CIC; KATHY POSEY, MPH, BS, CIC; TERRI ROBERTS, BS, CIC; KAREN CROYLE, BS, CIC; SHARON KRYSTOFIAK, MPH, MS, CIC; SUJATA PATEL-BROWN, BS; A. WILLIAM PASCULLE, SCD; DAVID L. PATERSON, MD; MELISSA SAUL, MS; LEE H. HARRISON, MD	273
Impact of Nosocomial Infection on Cost of Illness and Length of Stay in	
Intensive Care Units YIN-YIN CHEN, RN, PHD; YI-CHANG CHOU, BM; PESUS CHOU, DRPH	281

Continued inside.



## IT'S TIME FOR A CHANGE.

It's not just TB anymore. The challenges of infectious disease control are growing daily. Pathogens like SARS-CoV and avian influenza have altered the playing field because they have the potential to be transmitted via the airborne route.

New challenges call for new solutions. And that's where lnovel comes in.

We're a new company, licensed by Moldex,<sup>®</sup> one of the largest manufacturers of safety and personal protection products in the industrial market and holder of over 40 patents and numerous proprietary technologies.

Beginning with a complete line of respirators, we're now manufacturing products using these patented technologies and innovative designs specifically for the healthcare market.

Different by design, our patented, new generation of respirators are more comfortable, and because they're more durable, they can be worn longer. And, they're easier to put on and fit. In fact, in recent fit tests at Hollywood Presbyterian Medical Center, Inovel respirators achieved a 96% pass rate.

So don't delay, new additions to the list of airborne pathogens may be added at anytime. Call Inovel toll-free at 866.5.INOVEL (866-546-6835), ext. 500 today for free samples, or an informative product demo. Or visit our website at www.inovelmedical.com.

> 3100 SERIES N95 PARTICULATE RESPIRATOR &

> > 1500 N95 SERIES

3000 SERIES N95 PARTICULATE RESPIRATOR & SURGICAL MASK

SURGICAL MASK

10111 W. Jefferson Blvd., Culver City, CA 90232 Phone toll-free 866.5.INOVEL (866-546-6835), ext. 500 www.inovelmedical.com

2004 INOVEL LLC

מהו Different by design.

## INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY<sup>®</sup>

#### CONTENTS

Continued from cover

#### **ORIGINAL ARTICLES**

Health and Economic Consequences of an Outbreak of Pertussis Among Healthcare Workers in a Hospital in France Alexandra Ward, BPharm, MSc, PhD, MRPharmS; Jaime Caro, MDCM, FRCPC, FACP; Laurence Bassinet, MD;	
ALEXANDRA WARD, BPHARM, MSC, FHD, MIRPHARMS; JAIME CARO, MIDCM, FROFC, FACF; LAURENCE BASSINE1, MD; Bruno Housset, MD; Judith A. O'Brien, RN, BSPA; Nicole Guiso, PhD	288
Effect of Pressure Ulcers on Length of Hospital Stay Nicholas Graves, PhD; Frances Birrell, MAppEpid; Michael Whitby, FRCP	293
Knowledge of Standard and Isolation Precautions in a Large Teaching Hospital Hugo Sax, MD; Thomas Perneger, MD, PhD; Stéphane Hugonnet, MD, MSc; Pascale Herrault, RN; Marie-Noëlle Chraïti, RN; Didier Pittet, MD, MS	298
Attitudes and Perceptions Toward Hand Hygiene Among Healthcare Workers Caring for Critically III Neonates CARMEM LUCIA PESSOA-SILVA, MD; KLARA POSFAY-BARBE, MD; RICCARDO PFISTER, MD; SYLVIE TOUVENEAU, RN; THOMAS V. PERNEGER, MD, PHD; DIDIER PITTET, MD, MS	305
<b>Compliance With Hand Hygiene and Glove Use in a University-Affiliated Hospital</b> Nevin Kuzu, RN; Fadime Özer, RN; Semra Aydemir, RN; Ata Nevzat Yalcin, MD; Mehmet Zencir, MD	312
Efficiency of Hand Drying for Removing Bacteria From Washed Hands: Comparison of Paper Towel Drying With Warm Air Drying Yukiko Yamamoto, RN, PhD; Kazuhiro Ugai, MD, PhD; Yasuko Takahashi, RN, PhD	316
Surveillance and Infection Control in an Intensive Care Unit Giovanni Battista Orsi, MD; Massimiliano Raponi, MD; Cristiana Franchi, MD; Monica Rocco, MD; Carlo Mancini, MD; Mario Venditti, MD	32
IEDICAL NEWS Edited by Gina Pugliese, RN, MS; Martin S. Favero, PhD	327

#### Full-text articles available online at ICHEJournal.com

The publication of advertising in the Journal does not constitute any guarantee or endorsement by The Society for Healthcare Epidemiology of America or Slack Incorporated of the advertised product or service or of claims made by the advertiser. The publication of articles and other editorial material in the Journal does not necessarily represent the policy recommendations or endorsement by the Society.

PUBLISHER: Infection Control and Hospital Epidemiology (ISSN-0195-9417, Canadian GST#129780466) is published exclusively by SLACK Incorporated 12 times a year. Address: 6900 Grove Road, Thorofare, NJ 08086. Telephone: (856) 848-1000.

SHEA: 66 Canal Center Plaza, Suite 600, Alexandria, VA 22314; telephone, 703-299-0200; fax, 703-299-0204; e-mail address, info@shea-online.org.

COPYRIGHT 2005 The Society for Healthcare Epidemiology of America, Inc., and SLACK Incorporated. All rights reserved. No part of this publication may be reproduced without written permission from the publisher. Printed in the USA.

SUBSCRIPTIONS: Requests should be addressed to the publisher. Subscription rates in the United States and possessions: Individual: One year \$149.00; Two years \$253.00; Three years \$335.00; Institutional: One year \$279.00; Two years \$474.00; Three years \$628.00. Fellows: \$54.50 per year with proof of training status. Canada: add 7% Goods & Services tax; Overseas: add \$49.00 each year for delivery by air service. Single copies of current issues may be obtained for \$24.00.

INSTRUCTIONS TO AUTHORS: Authors may submit electronic versions of their manuscripts prepared in accordance with the 2004 revision of the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals." An electronic version is available at www.icmje.org. Submit to RapidReview.com. All submissions must be accompanied by copyright form(s) signed by all authors.

REPRINTS: All requests to reprint or use material published herein should be addressed to John Kain, SLACK Incorporated, 6900 Grove Road, Thorofare, NJ 08086. For reprint orders and prices, contact Rebecca Fogarty at (856) 848-1000. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by SLACK Incorporated, provided that the base fee of \$1.00 per copy, plus \$20 per page is paid directly to Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923; phone (978) 750-8400. This consent does not extend to other kinds of copying, such as for general distribution, resale, advertising and promotional purposes, or for creating new collective works.

CHANGE OF ADDRESS: Notice should be sent to the publisher 6 weeks in advance of effective date. Include old and new addresses with zip codes. The publisher cannot accept responsibility for undelivered copies. Periodicals postage paid at Thorofare, New Jersey 08086-9447 and at additional mailing offices. POSTMASTER: Send address changes to SLACK Incorporated, 6900 Grove Road, Thorofare, NJ 08086.

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY is listed in Index Medicus, Current Contents-Clinical Practice, Hospital Literature Index, Cumulative Index to Nursing & Allied Health Literature, Nursing Abstracts, Laboratory Performance Information Exchange System, and RNdex Top 100.

**EDITORIAL OFFICE** SLACK Incorporated 6900 Grove Road Thorofare, NJ 08086 (856) 848-1000; (856) 848-6091 (FAX) E-mail: iche@slackinc.com **EDITOR** William R. Jarvis, MD **DEPUTY EDITOR** David P. Calfee, MD, MS ASSISTANT EDITOR Preeti N. Malani, MD, MSJ SENIOR ASSOCIATE EDITORS C. Glen Mayhall, MD Gina Pugliese, RN, MS William Schaffner, MD ASSOCIATE EDITORS Donald A. Goldmann, MD Didier Pittet, MD, MS Andreas Widmer, MD, MS SECTION EDITORS **Bevond Infection Control:** The New Hospital Epidemiology Wing Hong Seto, MD Hong Kong **Disinfection and Sterilization** William A. Rutala, PhD, MPH Chapel Hill, North Carolina From the Laboratory Marcus Zervos, MD Royal Oak, Michigan Infections in Immunocompromised Patients Kent Sepkowitz, MD New York City, New York **Information Management** John A. Sellick, DO Amherst, New York **Issues in Surgery** James T. Lee, MD, PhD St. Paul, Minnesota **Medical News** Gina Pugliese, RN, MS Chicago, Illinois Martin S. Favero, PhD Irvine, California Practical Healthcare Epidemiology Loreen A. Herwaldt, MD Iowa City, Iowa Statistics for Hospital Epidemiology David Birnbaum, PhD, MPH Sidney, British Columbia, Canada Topics in Long-Term Care Philip W. Smith, MD Omaha, Nebraska **Topics in Occupational Medicine** David Weber, MD, MPH Chapel Hill, North Carolina

## INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY<sup>®</sup>

#### EDITORIAL ADVISORY BOARD

J. Wesley Alexander, MD Miriam Alter, PhD Hilary Babcock, MD Elise M. Beltrami, MD, MPH Richard E. Besser, MD Marc J. M. Bonten, MD, PhD John M. Boyce, MD Christian Brun-Buisson, MD John P. Burke, MD Yehuda Carmeli, MD, MPH Carol Chenoweth, MD Sara E. Cosgrove, MD, MS Donald E. Craven, MD Erika D'Agata, MD, MPH Franz Daschner, MD Patch Dellinger, MD Charles E. Edmiston, Jr., PhD Theodore C. Eickhoff, MD Jean Yves Fagon, MD, MPH Mark Farrington, MA, FRCPath Victoria J. Fraser, MD Richard A. Garibaldi, MD Petra Gastmeier, MD Dale N. Gerding, MD Stephan Harbarth, MD, MS Anthony D. Harris, MD, MPH David K. Henderson, MD Peter N.R. Heseltine, MD Karen Hoffmann, RN, CIC, MS Janine Jagger, MPH, PhD John A. Jernigan, MD, MS Jacob L. Kool, MD, PhD Ebbing Lautenbach, MD, MPH Allison McGeer, MD John E. McGowan, Jr., MD Leonard A. Mermel, DO, ScM Robert R. Muder, MD Carlene A. Muto, MD, MS Joseph M. Mylotte, MD, CIC Lindsay Nicolle, MD Juhani Ojajärvi, MD Michael T. Osterholm, PhD, MPH David L. Paterson, MBBS, FRACP Jan Evans Patterson, MD Sindy M. Paul, MD David A. Pegues, MD Michael A. Pfaller, MD Samuel Ponce de Leon, MD, MSc Isaam Raad, MD Jordi Rello, MD, PhD Manfred L. Rotter, MD, DipBact Henning Rüden, MD Lisa Saiman, MD, MPH Syed A. Sattar, PhD William E. Scheckler, MD Lynne M. Sehulster, PhD Andrew E. Simor, MD Denis W. Spelman, FRACP V. Susan Springthorpe, BSc, MSc Jeffrey R. Starke, MD Janet E. Stout, PhD Clyde Thornsberry, PhD Jerome Tokars, MD, MPH Timothy R. Townsend, MD Antoni Trilla, MD, PhD Robert A. Weinstein, MD Sergio B. Wey, MD

Cincinnati, Ohio Atlanta, Georgia St. Louis, Missouri Decatur, Georgia Atlanta, Georgia Utrecht, The Netherlands New Haven, Connecticut Creteil, France Salt Lake City, Utah Tel Aviv, Israel Ann Arbor, Michigan Baltimore, Maryland Burlington, Massachusetts Boston, Massachusetts Freiburg, Germany Seattle, Washington Milwaukee, Wisconsin Denver, Colorado Paris, France Cambridge, England, United Kingdom St. Louis, Missouri Farmington, Connecticut Hanover, Germany Hines, Illinois Geneva, Switzerland Baltimore, Maryland Bethesda, Maryland San Juan, California Chapel Hill, North Carolina Charlottesville, Virginia Atlanta, Georgia Fort Collins, Colorado Philadelphia, Pennsylvania Toronto, Ontario, Canada Atlanta, Georgia Providence, Rhode Island Pittsburgh, Pennsylvania Pittsburgh, Pennsylvania Buffalo, New York Winnepeg, Manitoba, Canada Helsinki, Finland Minneapolis, Minnesota Pittsburgh, Pennsylvania San Antonio, Texas Yardley, Pennsylvania Los Angeles, California Iowa City, Iowa Mexico City, Mexico Houston, Texas Tarragona, Spain Vienna, Austria Berlin, Germany New York, New York Ottawa, Ontario, Canada Madison, Wisconsin Atlanta, Georgia Toronto, Ontario, Canada Melbourne, Victoria, Australia Ottawa, Ontario, Canada Houston, Texas Pittsburgh, Pennsylvania Franklin, Tennessee Atlanta, Georgia Baltimore, Maryland Barcelona, Spain Chicago, Illinois São Paulo, Brazil

SLACK Incorporated, 6900 Grove Road, Thorofare, New Jersey 08086. (856) 848-1000

Executive Vice President Richard N. Roash Vice President, Publishing Operations John C. Carter Editorial Director Jennifer Kilpatrick **Executive Editor** Shirley P. Strunk, ELS Associate Editor Jaime Underwood

https://doi.org/10

Circulation Manager Lester J. Robeson, CCCP **Production Director** Christine Malin Vice President, U.S. Advertising Wayne McCourt **Director of Association Services** Kathy Huntley Advertising Sales Representative Scotty Turner 3X00197727 Published online by Cambridge University Press

Advertising Sales Administrator Ioanne Patterson Sales Director, Classified/Recruitment Kristy Irwin Classified/Recruitment Sales Elizabeth Roash **Director of Reprint Sales** John Kain

AMP



## For persistent antiseptic activity, you're in the clear with Hibiclens:

Clinical studies\* have proven the efficacy and persistence of Hibiclens, demonstrating how it goes to work on germs and provides a cumulative effect that continues to kill germs long after your shift is over.

The most recent study observed agar plates that were inoculated with staph aureus. Hands were washed with Hibiclens, and then pressed onto the inoculated plates - palms down. The plates were then incubated and a whitish film of staph aureus grew in areas not affected by Hibiclens.

Test on file. \*The darker color in the hand print shows the cumulative effect of Hibiclens on staph aureus, the fifth day of use, 6 hours after the final daily handwash.

The persistence of Hibiclens provides extra protection. Recommended antiseptic procedures of your institution should be followed when using Hibiclens.

Hibiclens, armed with its 4% Hibitane (CHG) formulation immediately killed germs and

displayed a cumulative effect that didn't know when to guit. In fact, this demonstration showed the antiseptic still killing on the fifth day of use and 6 hours after the final daily handwash.\*\*

Immediately kill and keep killing germs with **Hibiclens.** For more information, call 1-800-843-8497.



Regent Medical

From the makers of Hibiclens<sup>®</sup> and Biogel<sup>®</sup>, www.regentmedical.com. Regent, Biogel, Hibiclens, Regent logo, Biogel logo, and Hibiclens logo, are trade marks of Regent Medical, Ltd. Distributed by Regent Medical, Americas, LLC, Norcross, GA 30092. ©2005 Regent Medical, Ltd. All rights reserved.



#### SHEA/CDC Training Course in Healthcare Epidemiology

This course provides intensive training for professionals involved in the field of healthcare epidemiology, as well as those concerned with issues related to hospital epidemiology and infection control programs. The Society for Healthcare Epidemiology of America (SHEA) and the Centers for Diseases Control and Prevention (CDC), two of the nation's most prestigious healthcare organizations dedicated to continuous quality improvement in infection control and the application of epidemiology within the healthcare setting, provide the sponsorship for this course.

#### Join Your Colleagues at This One-Of-A-Kind Program

- A comprehensive introduction to epidemiologic methods
- An opportunity to solve "real life" hospital problems using "hands-on" exercises
- A review of surveillance techniques, including the use of computerized databases
- Targeted lectures on contemporary issues in healthcare epidemiology and infection control
- An introduction to quality improvement and safety challenges facing healthcare epidemiologists

#### Who Should Attend

- Infectious disease fellows who wish to complete the basic training in infection control and hospital epidemiology required of all infectious disease fellows, and those who wish to pursue active involvement in healthcare epidemiology/infection control
- Physicians, infection control professionals, nurses, microbiologists, public health officials, and other healthcare providers who are seeking experience in healthcare epidemiology and infection control, and others who have an interest in or responsibility for healthcare epidemiology and infection control

#### **Course Objectives**

As a result of attending this course, participants should be able to:

- Identify the major statistical methods applied to infectious diseases epidemiologic data
- Use appropriate data acquisition methods to assess validity, interpret statistical tests, and make causal relationships
- Understand and apply different surveillance techniques and computerization methods
- Define trends in transmission and control of healthcare-acquired infections and drug resistant-pathogens, as well as other emerging infections in the healthcare setting
- Discuss quality improvement (QI) methods that impact healthcare epidemiology and safety in the healthcare setting
- Understand the role of CDC in healthcare epidemiology in the US, including providing national healthcare epidemiology data and assistance in outbreak investigation, and disseminating, implementing, and evaluating evidence-based guidelines for the prevention of healthcareassociated infections and other adverse events

#### Please see

www.shea-online.org/about/shea\_courses.cfm for registration information.

## **Reprints. Reprints. Reprints.**



## Your story is worth repeating.

Article reprints offer an easy solution to help you distribute information to your patients and colleagues. When you find an article in INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY, don't bury it in the archives – spread the word with an INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY reprint.

#### Call today for a FREE quote and learn how INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY can help you.

#### Our professional customized article reprints offer:

- Quick turn-around time
- Full color or black-and-white reproduction
- 8.5" x 11" booklet bound format
- High-quality glossy stock

For a FREE quote, call John Kain, Director of Reprint Sales, at **1-800-257-8290**, ext. 238 (856-848-1000 in N.J. or outside the U.S.); e-mail: jkain@slackinc.com; or visit us online at **slackinc.com/reprints.** 

Also available electronically — call for details.

#### INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY

## Rapidly kills 150+ types of pathogens for one reason: to reduce the risk of infection

A nosocomial infection increases a patient's medical costs by an average of \$28,800.<sup>1</sup> That's why you need ACTICOAT<sup>o</sup>. The patented Nanocrystalline silver delivery system kills—not just repels—more than 150 clinically relevant wound pathogens. ACTICOAT protects against gram-negative and gram-positive bacteria, and antibiotic-resistant bacteria and fungal organisms, including tough ones such as *Pseudomonas*, Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant *Enterococcus* (VRE).

Smith&nephew

**ACTICOAT**<sup>°</sup>

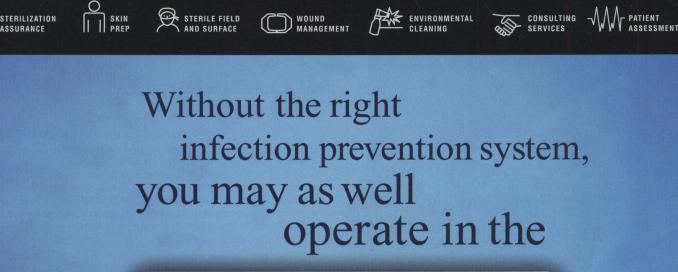
SILCRYST

Let ACTICOAT create the ultimate barrier of protection for a healthier wound-healing environment.

To learn more about ACTICOAT, visit www.acticoat.com or call 1-800-876-1261.

1. Rubin RJ, Harrington CA, Poon A, Dietrich K, Greene JA, Moiduddin A. The economic impact of *Staphylococcus aureus* infection in New York City hospitals. *Emerg Infect Dis.* 1999;5:9-17.

°Trademark of Smith & Nephew. Certain marks reg. US Pat & TM Off. SILCRYST is a trademark of NUCRYST Pharmaceutical Corp., used under license. 2004 Smith & Nephew





### **Introducing 3M Infection Prevention Solutions.**

Every step in the infection prevention process is critical, or your operating room could be as contaminated as the common areas. But who can keep up with all of the new products and research developments available today? We can.

At 3M, we are committed to helping health care facilities reduce the risk of nosocomial infections. So we not only

provide you with innovative products – we equip you with a comprehensive *system* of products, services and technical support, as well as educational and in-service programs all customized for your hospital.

For more information, call the 3M Health Care Customer Helpline at **1-800-228-3957** or click on www.3M.com/healthcare. We're with you, step by step.

3M Infection Prevention Solutions. A vital step in Infection Prevention.

© 3M 2004 TM-0185



3M Medical

*from the 3M Health Care family* ttps://doi.org/10.1017/S0899823X00197727 Published online by Cambridge University Press