Poster Abstract Session:

188. Multidrug-Resistant Gram Negative Rods

Saturday: 12:30 p.m. - 2:00 p.m.
Room: The Moscone Center: Poster Hall C

Presenters:

1577 **Pilot Testing of an Out-of-Country Medical Care Questionnaire with Screening and Cost Analysis of Pre-emptive Isolation for Carbapenem-resistant Enterobacteriaceae in a Large Canadian Health Region**
NIPUNIE RAJAPAKSE, MD[1], JOSEPH VAYALUMKAL, MD[1], DEBBIE LAM-LI[2], CRAIG PEARCE, M.SC[2], GWYNNE REES, M.SC[3], LINDA KAMHUKA, M.SC[3], GISELE PEIRANO, PHD[4], CORRINNE PIDHORNEY[5], KAREN HOPE, MSC[6], DANIEL GREGSON, MD[4], JOHANN PITOUT, MD[4], THOMAS LOUIE, MD[7] and JOHN CONLY, MD[7]; [1]Alberta Children's Hospital, University of Calgary, Calgary, AB, Canada, [2]Foothills Medical Center, Calgary, AB, Canada, [3]Alberta Children's Hospital, Calgary, AB, Canada, [4]University of Calgary, Calgary, AB, Canada, [5]Rockyview General Hospital, Calgary, AB, Canada, [6]Alberta Health Services, Calgary, AB, Canada, [7]Foothills Medical Center, University of Calgary, Calgary, AB, Canada

1578 **Rectal colonization by drug resistant Enterobacteriaceae among international patients hospitalized at Mayo Clinic, Rochester, Minnesota**
THERESA MADIGAN, MD, SHAWN VASOO, MD, SCOTT A. CUNNINGHAM, MT(ASCP), SM, PRITISH K. TOSH, MD, ROBIN PATEL, MD, FIDSA, FRCP(C), D(ABMM), FACP, F(AAM), PRIYA SAMPATHKUMAR, MD and RITU BANERJEE, MD, PHD; Mayo Clinic, Rochester, MN

1579 **Risk factors for ambulatory urinary tract infections caused by high MIC-fluoroquinolone susceptible E. coli in women**
PINYO RATTANAUMPAWAN, MD, MSCE[1], IRVING NACHAMKIN, DRPH, MPH[1], JOSHUA METLAY, MD, PHD[1], THEOKLIS ZAOUTIS, MD, MSCE[1], WARREN BILKER, PHD[1], JASON ROY, PHD[1], EBBING LAUTENBACH, MD, MPH, MSCE[1] and FOR THE CDC PREVENTION EPICENTER PROGRAM; [1]University of Pennsylvania, Perelman School of Medicine, Philadelphia, PA

1580 **Prevalence of antibiotic resistance among P. aeruginosa in US hospitals, 2000-2009**
MARYA D. ZILBERBERG, MD, MPH; University of Massachusetts and Evimed Research Group, LLC, Goshen, MA and ANDREW F. SHORR, MD, MPH; Washington Hospital Center, Washington, DC

1581 **Risk Factors for gyrA and parC Mutations in Pseudomonas aeruginosa: A Case-Case-Control Study**
VALERIE CLUZET, MD[1], EBBING LAUTENBACH, MD, MPH, MSCE[2], IRVING NACHAMKIN, DRPH, MPH[3], MARK CARY, PHD[3], KNASHAWN H. MORALES, SCD[1], DARREN R. LINKIN, MD, MSCE[2] and THE CDC PREVENTION EPICENTER PROGRAM; [1]Hospital of the University of Pennsylvania, Philadelphia, PA, [2]University of Pennsylvania School of Medicine, Philadelphia, PA, [3]University of Pennsylvania, Perelman School of Medicine, Philadelphia, PA

1582 **Acinetobacter baumannii: where is it all coming from?**
JENNICA JOHNS, MD (AS OF 5/2/2013); The Ohio State University's Wexner Medical Center, Columbus, OH and JULIE E. MANGINO, MD; The Ohio State University Wexner Medical Center, Columbus, OH

1583 **Adult Intensive Care Unit Acquired Nosocomial Multi-Drug Resistant Acinetobacter Infections: Epidemiology, Risk Factors and Genotyping Analysis**
SIRVAN ELMAS DAL, **FUNDA YETKIN**, BARIS OTLU, CIGDEM KUZUCU and YASEMIN ERSOY; Inonu University Faculty of Medicine, Malatya, Turkey

1584 **Endemic Cross-transmission of Carbapenem resistant Acinetobacter baumannii in King Fahd Hospital Jeddah: a cohort study**
MUHAMMAD ABDULRAHAMAN HALWANI, MSC, PHD, FJHMI[1], NUHA AL HUMIDI, MSC[2], SAAD AL MASOUDI, PHD[3], MAGDA ALY, PHD[3] and OSAMA DHAFAR, MD[4]; [1]Al Baha University, Faculty of Medicine, Al Baha, Saudi Arabia, [2]King Fahd Hospital, Jeddah, Saudi Arabia, [3]King Abdulaziz University, Jeddah, Saudi Arabia, [4]Health Affairs, Jeddah, Saudi Arabia

1585 **Epidemiology & Risk Factors for Colistin-Resistant Gram-Negative Infections in an Inner City Tertiary Care Hospital**
FRANTZ PIERRE-LOUIS, MD[1], SHIN-PUNG JEN, PHARMD[2] and LISA DEVER, MD[1]; [1]UMDNJ-New Jersey Medical School, Newark, NJ, [2]University Hospital, Newark, NJ

1586 **Description of Infections Caused by Polymyxin Resistant Enterobacteriaceae and Associated Mortality.**
CLÁUDIA CARRILHO, MD[1], JAMILE VALE, STUDENT[1], MARSILENI PELISSON, MDPHARM[1], LARISSA OLIVEIRA[2], ANA PAULA MARCHI[3], CINTIA GRION, PHD[1] and SILVIA COSTA, MD, PHD[4]; [1]Universidade Estadual de Londrina, Londrina-PR, Brazil, [2]HOSPITAL DAS CLINICAS

OF UNIVERSITY OF SAO PAULO, SAO PAULO, Brazil, [3]Hospital Das Clínicas Da Faculdade De Medicina Da Universidade De São Paulo, Sao Paulo, Brazil, [4]Hospital Das Clínicas Da Faculdade De Medicina Da Universidade De São Paulo, São Paulo, Brazil

1587 **Colistin and carbapenen resistants isolates of Klebsiella pneumoniae emerging in Brazil: report of ten cases**
LUCY NAGM, MD[1], NAíMA MORTARI, MD[1], ÍCARO BOSZCZOWSKI, MD, MSC[2], MARISTELA FREIRE, MD, MSC[1], ANDRE DOI, MD[1], FLAVIA ROSSI, MD PHD[3] and **THAíS GUIMARãES, MD, PHD**[1]; [1]Instituto Central - Hospital Das Clínicas, São Paulo, Brazil, [2]Instituto Central - Hospital Das Clínicas, Sao Paulo, Brazil, [3]Hospital Das Clínicas, SAO PAULO, Brazil

1588 **Prevalence and Risk Factors for Carbapenem Resistant and Extended Spectrum Beta-lactamase-producing Bacterial Acquisition in a Thai University Hospital Setting**
SASISOPIN KIERTIBURANAKUL, MD, MHS, BOOSSARAKUM NINLAPUN, MD, SUNTAREEYA SIRICHOTE, MSC, SOMPORN SOMSAKUL, BSC, PITAK SANTANIRAND, PHD and KUMTHORN MALATHUM, MD; Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

1589 **Statewide spatial distribution of catheter-related bloodstream infection caused by multidrug-resistant organisms in intensive care units in São Paulo State, Brazil**
ÍCARO BOSZCZOWSKI, MD, MSC; Instituto Central - Hospital Das Clínicas, Sao Paulo, Brazil, FRANCISCO CHIARAVALLOTI NETO, PHD; Public Health School University of Sao Paulo, Sao Paulo, Brazil, GERALDINE MADALOSSO, MD MSC; Health State Department Sao Paulo, Sao Paulo, Brazil, DENISE ASSIS; Centro de Vigilância Epidemiológica, State Health Department, São Paulo , Brazil, THAIS BASSO, ENGINEER; Lemc, Sao Paulo, Brazil and ANNA SARA LEVIN, MD, PHD; University of São Paulo, São Paulo, Brazil

1591 **Fosfomycin Resistance is Associated with Receipt of Incorrect Empiric Therapy for Multidrug Resistant Uropathogens**
KATHERINE LINSENMEYER, MD[1], JUDITH STRYMISH, MD[2], SUSAN WEIR, MPH, PHD[1], GRETCHEN BERG[3], STEPHEN BRECHER, PHD[3] and KALPANA GUPTA, MD, MPH[1]; [1]Department of Medicine/Boston University School of Medicine, Boston, MA, [2]Harvard Medical School, Boston, MA, [3]VA Boston HCS, West Roxbury, MA

1592 **Fosfomycin Minimum Inhibitory Concentrations in Multi-Drug Resistant Organisms of Uncomplicated Urinary Tract Infections**
KEVIN MCDONOUGH, BS, PHARMD , MPA; Cardinal Health. Pharm. Services, East Orange, NJ, BHAVNA DESAI, BS, MT(ASCP), CIC; St Mary's Hospital, Passaic, NJ, GERRY SOMERA, BSMP; East Orange General Hospital, East Orange, NJ and DIANA FINKEL, DO; St. Mary's Hospital, Passaic, NJ

1593 **Prevalence and Risk Factors for Extended Spectrum Beta-Lactamase Producing Organisms among Patients with Complicated Urinary Tract Infections**
ROSALLY ZAMORA, MD[1], KAREN MARIE GREGORIO, MD[1], RAUL DESTURA, MD[2] and MARISSA ALEJANDRIA, MD[1]; [1]University of the Philippines-Philippine General Hospital, Manila, Philippines, [2]National Institutes of Health - University of the Philippines Manila, Manila, Philippines

1594 **Multidrug Resistant Enterobacteriaceae in a Suburban Community Teaching Hospital; A Retrospective Analysis**
NEHA CHOPRA, MD and THOMAS TREADWELL, MD; Metro West Medical Center, Framingham, MA

1595 **In Vitro Activity of Ertapenem and Comparators against Aerobic Gram-negative Intra-Abdominal Infection (IAI) Pathogens in the USA—SMART 2012**
ROBERT BADAL, B.S.[1], SIBYLLE LOB, MD, MPH[1], DARYL HOBAN, PHD[1], SAMUEL BOUCHILLON, MD[1], MEREDITH HACKEL, PHD, MPH[1], DOUGLAS BIEDENBACH, BS[1], STEPHEN HAWSER, PHD[2] and IAN MORRISSEY, PHD[2]; [1]International Health Management Associates, Inc., Schaumburg, IL, [2]IHMA Europe Sàrl, Epalinges, Switzerland

1596 **Epidemiology and Susceptibility of Pathogens from Hospital- and Community-Associated Urinary Tract Infection in Latin America: SMART 2010-2012**
SIBYLLE LOB, MD, MPH[1], **ROBERT BADAL, B.S.**[1], DARYL HOBAN, PHD[1], SAMUEL BOUCHILLON, MD[1], MEREDITH HACKEL, PHD, MPH[1], DOUGLAS BIEDENBACH, BS[1], STEPHEN HAWSER, PHD[2] and IAN MORRISSEY, PHD[2]; [1]International Health Management Associates, Inc., Schaumburg, IL, [2]IHMA Europe Sàrl, Epalinges, Switzerland

1597 **Epidemiology of ESBL-Producers in Intra-Abdominal Infections in Adults in ICU versus non-ICU wards in North America: SMART 2010-2012**
SIBYLLE LOB, MD, MPH[1], **ROBERT BADAL, B.S.**[1], DARYL HOBAN, PHD[1], SAMUEL BOUCHILLON, MD[1], MEREDITH HACKEL, PHD, MPH[1], DOUGLAS BIEDENBACH, BS[1], STEPHEN HAWSER, PHD[2] and IAN MORRISSEY, PHD[2]; [1]International Health Management Associates, Inc., Schaumburg, IL, [2]IHMA Europe Sàrl, Epalinges, Switzerland

1598 **Epidemiology of CTX-M-type extended-spectrum ?-lactamase (ESBL)-**

producing Escherichia coli among older adults
SACHI MATSUBAYASHI[1], SAMEEN FAROOQ[2], KAYOKO HAYAKAWA, M.D., PHD[2], DROR MARCHAIM, MD[2] and KEITH KAYE, MD, MPH, FIDSA, FSHEA[3]; [1]Jikei University School of Medicine, Tokyo, Japan, [2]Detroit Medical Center (DMC) / Wayne State University, Detroit, MI, [3]Detroit Medical Center/ Wayne State University, Detroit, MI

1599 **The Effect of a Hospital-Wide Urine Culture Screening Intervention on the Incidence of Extended-Spectrum Beta-Lactamase (ESBL)-Producing Escherichia coli and Klebsiella Species**
JENNIFER HAN, MD, MSCE[1], WARREN BILKER, PHD[2], IRVING NACHAMKIN, DRPH, MPH[2], THEOKLIS ZAOUTIS, MD, MSCE[3], SUSAN COFFIN, MD, MPH[3], DARREN R. LINKIN, MD, MSCE[1], BAOFENG HU, MD[1], PAM TOLOMEO, MPH[1], NEIL FISHMAN, MD[1], EBBING LAUTENBACH, MD, MPH, MSCE[1] and THE CDC PREVENTION EPICENTER PROGRAM; [1]University of Pennsylvania School of Medicine, Philadelphia, PA, [2]University of Pennsylvania, Perelman School of Medicine, Philadelphia, PA, [3]The Children's Hospital of Philadelphia, Philadelphia, PA

1600 **Sharing of Escherichia coli Sequence Type ST131 and other E. coli among Household (HH) Members**
AYLIN COLPAN, MD[1], CONNIE CLABOTS[2], JAMES TACKLIND, PHD[2], STEPHEN PORTER[2] and JAMES R. JOHNSON, MD[1]; [1]University of Minnesota, Minneapolis, MN, [2]Minneapolis VA Medical Center, Minneapolis, MN

1601 **Surveillance for Klebsiella pneumoniae Carbapenemase (KPC)-Producing Enterobacteriaceae**
KRISTIN M SHAW, MPH, CIC, **JANE HARPER, BSN, MS, CIC**, PAULA SNIPPES VAGNONE, MT (ASCP) and RUTH LYNFIELD, MD; Minnesota Department of Health, St. Paul, MN

1602 **Characterization of Carbapenem-resistant Enterobacteriaceae Isolates Collected through the Emerging Infections Program Network**
SANDRA BULENS, MPH[1], DAVID LONSWAY, MMSC[2], TATIANA TRAVIS, BS[2], J. KAMILE RASHEED, PHD[2], BRANDI LIMBAGO, PHD[2], RUTH LYNFIELD, MD[3], KRISTIN M SHAW, MPH, CIC[3], PAULA M SNIPPES VAGNONE, MT (ASCP)[3], JESSE JACOB, MD[4], JESSICA RENO, MPH[5], WENDY BAMBERG, MD[6], SARAH JACKSON JANELLE, MPH[7], ZINTARS G. BELDAVS, MS[8], MARGARET CUNNINGHAM, MPH[8] and ALEXANDER KALLEN, MD, MPH[2]; [1]Centers for Disease Control and Prevention, Division of Healthcare Quality Promotion, Atlanta, GA, [2]Centers for Disease Control and Prevention, Atlanta, GA, [3]Minnesota Department of Health, St. Paul, MN, [4]Emory University School of Medicine, Atlanta, GA, [5]Atlanta Veterans Affairs Medical Center, Decatur, GA, [6]Colorado Dept. of Public Health and Environment, Denver, CO, [7]Colorado Department of Public Health and Environment, Denver, CO, [8]Oregon Health Authority, Portland, OR

1603 **Variation in Definitions and Isolation Procedures for Multidrug-resistant Gram-negative Bacilli: a Survey of the SHEA Research Network**
MARCI DREES, MD, MS[1], LISA PINELES, MA[2], ANTHONY HARRIS, MD, MPH[2] and DANIEL MORGAN, MD, MS[2]; [1]Christiana Care Health System, Newark, DE, [2]University of Maryland School of Medicine, Baltimore, MD

1604 **Carbapenem Resistant Klebsiella pneumoniae: Epidemiology of the Regional Spread in Southern Indiana and Barriers for Prevention**
EMILIAN ARMEANU, MD[1], JOSE SALGADO, MD, MPH[2], MARCIA MORGAN, MS[2], MUBASHIR ZAHID, MD[1] and GAYLE STUBBS, PHD[1]; [1]Deaconess Hospital, Evansville, IN, [2]St. Mary Medical Center, Evansville, IN

1605 **Statewide Acute Care Survey on Practices Regarding Carbapenem-Resistant Enterobacteriaceae in Oregon**
TASHA POISSANT, MPH[1], CHRISTOPHER PFEIFFER, MD[2], MARGARET CUNNINGHAM, MPH[1], ANN THOMAS, MD, MPH[1], JON FURUNO, PHD[3], JOHN M. TOWNES, MD[4] and ZINTARS G. BELDAVS, MS[1]; [1]Oregon Health Authority, Portland, OR, [2]Portland VA Medical Center, Portland, OR, [3]Oregon State University, Portland, OR, [4]Oregon Health and Science University, Portland, OR

1606 **Characteristics of Carbapenem-resistant Enterobacteriaceae-positive Patients in Oregon**
ANDREW LEITZ, MD[1], MARGARET CUNNINGHAM, MPH[2], TASHA POISSANT, MPH[2], ANN THOMAS, MD, MPH[2], J. TOWNES, MD[1], JON FURUNO, PHD[1], ZINTARS G. BELDAVS, MS[2] and CHRISTOPHER PFEIFFER, MD[1]; [1]Oregon Health & Science University, Portland, OR, [2]Oregon Health Authority, Portland, OR

1607 **Associated Mortality Among Carbapenem-resistant Klebsiella pneumoniae cases in Los Angeles County Using Electronic Death Registry Data - 2010-2012**
PATRICIA MARQUEZ, MPH, DAWN TERASHITA, MD, MPH and LAURENE MASCOLA, MD, MPH; Los Angeles County Department of Public Health, Los Angeles, CA

1608 **Risk Factors and Mortality in Carbapenem Resistant Gram Negative Bacteremias: A Retrospective Analysis from a Tertiary Health Care Setting in**

India
PURNIMA PARTHASARATHY, MBBS, AMERICAN BOARD CERTIFIED IN INTERNAL MEDICINE AND INFECTIOUS DISEASES; Apollo Hospitals, Bangalore, India

1609 **The natural history of colonization with carbapenem-resistant Enterobacteriaceae: outcomes related to colonization**
BROOKE K. DECKER, MD[1], AMANDA M. HEATH[1], DAVID K. HENDERSON, MD[2] and TARA N. PALMORE, MD[3]; [1]National Institutes of Health, Bethesda, MD, [2]National Institutes of Health Clinical Center, NIH, Bethesda, MD, [3]National Institutes of Health Clinical Center and National Institute of Allergy and Infectious Diseases, NIH, Bethesda, MD

1610 **Risk for Readmissions in Hospitalized Patients with Carbapenem-Resistant Klebsiella pneumoniae**
DAVID VAN DUIN, MD, PHD[1], ERIC COBER, MD[2], FEDERICO PEREZ, MD[3], KEITH KAYE, MD, MPH, FIDSA, FSHEA[4], STEVEN GORDON, MD, FIDSA, FSHEA[2], ROBERT KALAYJIAN, MD[5], ROBERT SALATA, MD[6], ROBERT A. BONOMO, MD[7] and CRKP CONSORTIUM; [1]Cleveland Clinic Foundation, Cleveland, OH, [2]Cleveland Clinic, Cleveland, OH, [3]University Hospitals Case Medical Center, Cleveland Heights, OH, [4]Detroit Medical Center/ Wayne State University, Detroit, MI, [5]The Metrohealth Medical Center, Cleveland, OH, [6]University Hospitals Case Medical Center, Cleveland, OH, [7]Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH

1611 **Hospital Surveillance for Carbapenemase-Producing Organisms in the Wake of an Outbreak**
ROBIN T. ODOM, M.S.[1], AMANDA M. RAMSBURG, R.N.[1], ANGELA V. MICHELIN, M.P.H.[1], MARY ANN BORDNER, M.S.[1], ANNA F. LAU, PH.D.[2], DAVID K. HENDERSON, MD[1] and TARA N. PALMORE, MD[3]; [1]National Institutes of Health Clinical Center, NIH, Bethesda, MD, [2]National Institutes of Health, Bethesda, MD, [3]National Institutes of Health Clinical Center and Niaid, NIH, Bethesda, MD

1612 **Outcomes of an Enhanced Surveillance Program for Carbapenem-resistant Enterobacteriaceae (CRE)**
MARGARET FITZPATRICK, MD[1], TERESA ZEMBOWER, MD, MPH[1], CHAO QI, PHD[1], MICHAEL MALCZYNSKI, BS[2] and MAUREEN K. BOLON, MD, MS[1]; [1]Northwestern University Feinberg School of Medicine, Chicago, IL, [2]Northwestern Memorial Hospital, Chicago, IL

1613 **Multidrug-Resistant Enterobacteriaceae: Prevalence of Gastrointestinal Colonization and Short-Term Secondary Transmission in a Tertiary-Care Hospital**
PHILIPPE MORENCY-POTVIN, MD[1], VALERY LAVERGNE, MD, MSC, FRCPC[1], CHANTAL CLOUTIER[1], BRIGITTE LEFEBVRE, PHD[2], GILBERT PICHETTE, MD, FRCPC[1] and CATHERINE TSIMIKLIS, MD[1]; [1]Hôpital Du Sacré-Coeur De Montréal, Montréal, QC, Canada, [2]Laboratoire De Sante Publique Du Quebec, Ste-Anne-de-Bellevue, QC, Canada

1614 **How fast do patients acquire Klebsiella pneumoniae (Kp) containing blaKPC (Kp KPC)? An Analysis of Epidemiology of Kp KPC at a Long-Term Acute Care Facility**
REDA AWALI, MD, MPH[1], CAITLIN BIEDRON, M.S.[2], UZMA IMRAN, MD[1], OLUFEMI JEGEDE, MPH[1], HARLEEN KAUR, MD[1], BRINDHA GOPALA KRISHNAN, MD[1], SATYA DATLA, MBBS[1], DINA BOIKOV, MD[1], WILLIAM LEBAR, MS[3], ROBERT A. BONOMO, MD[4], FEDERICO PEREZ, MD[5], KEITH KAYE, MD, MPH, FIDSA, FSHEA[1] and **TEENA CHOPRA, MD, MPH**[1]; [1]Detroit Medical Center/ Wayne State University, Detroit, MI, [2]Wayne State University, Detroit, MI, [3]Univeristy of Michigan, Ann Arbor, MI, [4]Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH, [5]University Hospitals Case Medical Center, Cleveland Heights, OH

1615 **The effectiveness of routine daily chlorhexidine (CHG) bathing in reducing Klebsiella pneumoniae carbapenemase-producing Enterobacteriaceae (KPC) skin burden among long-term acute care hospital (LTACH) patients**
MICHAEL Y. LIN, MD, MPH[1], DONALD BLOM, RN, BA[1], ROSIE D. LYLES-BANKS, MD, MHA[2], KAREN LOLANS, BS[3], NICHOLAS MOORE, MS, MLS(ASCP)[1], SHAYNA WEINER, MPH[1], CAROLINE J. THURLOW, MD[1], MONICA K. SIKKA, MD[3], DAVID W. HINES, MD[4], ROBERT A WEINSTEIN, MD, FIDSA[1], MARY K HAYDEN, MD, FSHEA, FIDSA[3] and FOR THE CDC PREVENTION EPICENTER PROGRAM; [1]Rush University Medical Center, Chicago, IL, [2]Cook County Health and Hospitals System, Chicago, IL, [3]Rush Univ. Med. Ctr., Chicago, IL, [4]Metro Infectious Diseases Consultants, LLC, Burr Ridge, IL

1616 **Carbapenem-Resistant Klebsiella pneumoniae Cluster in a Long-term Skilled Nursing Facility Highlights the Role of Local Public Health in Prevention and Control**
JENNIFER SEARS, BS, MPH; Philadelphia Department of Public Health, Philadelphia, PA and AMI S. PATEL, PHD; Centers for Disease Control and Prevention, Philadelphia, PA

1617 **Targeted Infection Prevention (TIP) Study: Epidemiology of antibiotic resistant gram-negative bacilli colonization in nursing home residents with indwelling devices**
SARA MCNAMARA, MT(ASCP), MPH; University of Michigan and Ann Arbor VA Healthcare System, Ann Arbor, MI, BONNIE LANSING, LPN; AnVA Healthcare System, Ann

Arbor, MI, KATHY SYMONS, BA; Ann Arbor VA Healthcare System, Ann Arbor, MI, LONA MODY, MD, MSC; University of Michigan, Ann Arbor, MI and TIP STUDY TEAM

1618 **Proactive infection control measures to prevent nosocomial transmission of carbapenem-resistant Enterobacteriaceae in a non-endemic area**
VINCENT CC CHENG, MBBS, MD, FRCPATH[1], JASPER FW CHAN, MBBS, FRCPATH[2], SALLY CY WONG, MBBS, MRCP[2], JOSEPHA WM TAI, MHSC(N)[3], KELVIN K. W. TO, MBBS FRCPATH[2] and KWOK-YUNG YUEN, MD[3]; [1]Queen Mary Hospital, Hong Kong, Hong Kong, [2]The University of Hong Kong, Hong Kong, Hong Kong, [3]Carol Yu Centre for Infection, The University of Hong Kong, Hong Kong, Hong Kong

1619 **Carbapenem-resistant Enterobacteriaceae (CRE) Klebsiella pneumonia (KP) Cluster Analysis**
SHEILA MCCOOL, BSN, MPH, CIC[1], LLOYD CLARKE, B SC (HONS)[1], ASHLEY QUERRY, BS[2], ANTHONY PASCULLE, SCD[3], LAURIE RACK, DNP, RN, NEA-BC[4], CHAD NEILSEN, BS, MPH[5] and CARLENE MUTO, MD, MS, FSHEA[6]; [1]UPMC, Pittsburgh, PA, [2]University of Pittsburgh Medical Center - Presbyterian Hospital, Pittsburgh, PA, [3]University of Pittsburgh Medical Center, Pittsburgh, PA, [4]University of Pittsburgh Medical Center - Presbyterian University Hospital, Pittsburgh, PA, [5]University of Pittsburgh Medical Center-Presbyterian Hospital, Pittsburgh, PA, [6]University of Pittsburgh Medical Center, Presbyterian University Hospital, Pittsburgh, PA

1620 **Molecular epidemiology and antibiotic susceptibility of IMP-type metallo-?-lactamase-producing Enterobacter cloacae isolated in a tertiary medical center in Japan**
TOHRU MIYOSHI-AKIYAMA, **KAYOKO HAYAKAWA, M.D., PHD**, MAKI NAGAMATSU, KAYO SHIMADA, KAZUHISA MESAKI, SHIHO KUBOTA, EMI KURODA, YUKO SUGIKI, MASAYOSHI TOJO, NOZOMI TAKESHITA, MUGEN UJIIE, SATOSHI KUTSUNA, M.D., PHD, YOHEI HAMADA, NORIO OHMAGARI and TERUO KIRIKAE; National Center for Global Health and Medicine, Tokyo, Japan

1621 **Emergence of VIM-producing Aeromonas caviae in Israeli hospitals**
AMOS ADLER[1], MARC V. ASSOUS[2], SVETLANA PAIKIN[3], ANASTASIA SHULMAN[1], SARAH HILLEL[2], RIMA ARONOV[3], YEHUDA CARMELI[1] and **MITCHELL J. SCHWABER**[1]; [1]National Center for Infection Control, Tel Aviv, Israel, [2]Shaare Zedek Medical Center, Jerusalem, Israel, [3]Laniado Hospital, Netanya, Israel

1622 **Impact of intensive infection control team activities on the acquisition of methicillin-resistant Staphylococcus aureus, drug-resistant Pseudomonas aeruginosa and the incidence of Clostridium difficile-associated disease**
HIROMICHI SUZUKI, MD[1], JUNKO SENDA[1], YASUHARU TOKUDA, MD, MPH[2], KEITA YAMASHITA[1], NORIKO KOTAKI[1], HIROKO ISHIHARA[1] and HIROICHI ISHIKAWA, MD, PHD[1]; [1]Tsukuba Medical Center Hospital, Tsukuba, Japan, [2]Mito Kyodo General Hospital, University of Tsukuba, Mito, Japan

1623 **Utility of surveillance cultures for carbapenem-resistant Enterobacteriaceae, carbapenem-resistant Pseudomonas aeruginosa and vancomycin-resistant enterococci in bone marrow transplantation unit**
LíSIA G M M TOMICH, MD[1], LAURO PERDIGãO NETO[1], MARJORIE VIEIRA[1], JESSICA RAMOS, MD[1], LUCAS CHAVES, MD[1], THAIS GUIMARãES, MD, PHD[2], ANNA SARA LEVIN, MD, PHD[3] and SILVIA COSTA, MD, PHD[1]; [1]Hospital Das Clínicas-FMUSP, São Paulo, Brazil, [2]Instituto Central - Hospital Das Clínicas, São Paulo, Brazil, [3]University of São Paulo, São Paulo, Brazil

1624 **A single genotype of multidrug resistant (MDR) Acinetobacter baumannii expresses multiple antibiotic susceptibility phenotypes**
TIMOTHY L. WIEMKEN, PHD, MPH, CIC[1], SUSAN RUDIN, BS[2], MICHAEL JACOBS, MD[3], ROBERT A. BONOMO, MD[2], ROBERT KELLEY, PHD[1], EMILY PACHOLSKI, MPHC[1] and JULIO RAMIREZ, MD[1]; [1]University of Louisville, Louisville, KY, [2]Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH, [3]Case Western Reserve University/University Hospitals of Cleveland, Cleveland, OH

Session #188 Presentations:

1577. Pilot Testing of an Out-of-Country Medical Care Questionnaire with Screening and Cost Analysis of Pre-emptive Isolation for Carbapenem-resistant Enterobacteriaceae in a Large Canadian Health Region

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

NIPUNIE RAJAPAKSE, MD[1], JOSEPH VAYALUMKAL, MD[1], DEBBIE LAM-LI[2], CRAIG PEARCE, M.SC[2], GWYNNE REES, M.SC[3], LINDA KAMHUKA, M.SC[3], GISELE PEIRANO, PHD[4], CORRINNE PIDHORNEY[5], KAREN HOPE, MSC[6], DANIEL GREGSON, MD[4], JOHANN PITOUT, MD[4], THOMAS LOUIE, MD[7] and JOHN CONLY, MD[7]; [1]Alberta Children's Hospital, University of Calgary, Calgary, AB, Canada, [2]Foothills Medical Center, Calgary, AB, Canada, [3]Alberta Children's Hospital, Calgary, AB, Canada, [4]University of Calgary, Calgary, AB, Canada, [5]Rockyview General Hospital, Calgary, AB, Canada, [6]Alberta Health Services, Calgary, AB, Canada, [7]Foothills Medical Center, University of Calgary, Calgary, AB, Canada

Background: The spread of carbapenem-resistant Enterobacteriaceae (CRE) is an important public health concern. A key risk factor for CRE acquisition is the receipt of out-of-country medical care (OCMC). Prompt identification and isolation of patients with CRE has significant resource implications. We sought to determine the proportion of admitted patients in our health region who received OCMC in the previous 12 months, assess their CRE colonization status and estimate the cost associated with a pre-emptive isolation strategy.

Methods: A screening OCMC questionnaire was developed and piloted at four hospitals from 17/07/12- 05/09/12. The questionnaire inquired about location and type (inpatient vs. outpatient) of OCMC and was administered by the clerk or nurse at the time of admission. Screening for CRE colonization was done by rectal swab or stool sample using CHROMagar™ KPC screening media. Costs (Bank of Canada 2013 inflation adjusted) for pre-emptive isolation were extrapolated from previously published data on resistant gram-negatives in a large Canadian hospital (Conterno, J Hosp Inf 2007).

Results: Over the 2 month study period there were 13 835 admissions. Screening questionnaires were administered to 6646 patients (48%). Out of all patients screened 206 (3.1%) were found to have received OCMC. Outpatient visits comprised 59%, 18% were inpatient hospitalizations, and 16% had both types of care. The most common locations were the United States (34%), Asia (23%), Europe (15%) and Central/South America (11%). CRE screening samples were obtained for 101 patients (49%). No patients were colonized with CRE. Extrapolating to a full year yielded 2573 OCMC recipients requiring pre-emptive isolation at a cost of $2 380 025/year ($925/patient isolated). The cost of isolating only recipients of inpatient OCMC would be $809 375/year.

Conclusion: With increasing rates of travel and medical tourism more patients are receiving OCMC. Though this point-prevalence study did not identify any CRE colonized patients, ongoing surveillance and stringent infection control practices will be critical for identifying and limiting the spread of CRE amongst hospitalized patients in Canada. A pre-emptive isolation strategy has significant resource implications and is not practical at this time.

1578. Rectal colonization by drug resistant Enterobacteriaceae among international patients hospitalized at Mayo Clinic, Rochester, Minnesota

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: International travel and medical tourism have been associated with spread of resistant Enterobacteriaceae, including third generation cephalosporin- and carbapenem-resistant Enterobacteriaceae (CRE). The epidemiology of colonization with such organisms among international patients hospitalized in the United States has not been defined.

Methods: Consecutive international patients hospitalized at Mayo Clinic, Rochester, MN from February 2013 onwards were enrolled. All participants provided informed consent, a stool specimen or perirectal swab, and completed a survey. CRE carriage was assessed by real-time PCR for *Klebsiella pneumoniae* carbapenemase and New Delhi-metallo-β-lactamase directly, and after overnight enrichment in tryptic soy broth. Specimens were also cultured on HardyCHROM^{TM}ESBL Agar, and in broth. After overnight incubation, broth was plated on eosin-methylene blue agar and screened for CREs using the CDC-recommended method. MALDI-TOF mass spectrometry and antimicrobial susceptibility testing were performed on isolates. Fisher's exact or Chi Square tests were used for comparison of proportions.

Results: 69 patients from 27 different countries were screened during the first 3 months of the study. Most patients were from the Middle East (58%),followed by North America (12%), Asia (12%), Europe (9%), South America (7%), and other regions (3%). No CRE were detected, but 15 (22%) patients were colonized with third generation cephalosporin non-susceptible Enterobacteriaeceae. Carriage of cephalosporin non-susceptible Enterobacteriaceae was associated with hospitalization in the prior six months (RR 1.7, 95% CI 1.1-2.6, p = 0.04) and placement of a central venous catheter (CVC) within the past year (RR 3.1, 95% CI 1.2-7.8, p = 0.03).

Conclusion: No CRE colonization was identified during interim analysis of this study of international patients hospitalized in the United States. Carriage of cephalosporin non-susceptible Enterobacteriaceae was found in 22% of patients, mostly from the Middle East; a history of hospitalization or having a CVC were risk factors for carriage.

1579. Risk factors for ambulatory urinary tract infections caused by high MIC-fluoroquinolone susceptible E. coli in women

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Several studies have reported an increasing prevalence of high MIC fluoroquinolone susceptible *E. coli* (high MIC-FQSEC) which are the *E. coli* isolates with reduced susceptibility to FQs. High MIC-FQSEC potentially results in development of fully FQ-resistance and delayed response to FQ therapy. To date, risk factors for infection caused by high MIC-FQSEC have never been successfully identified. Our study aimed to identify risk factors for ambulatory urinary tract infections (UTIs) caused by high MIC-FQSEC in women.

Methods: We conducted a case-control study of female subjects with UTIs caused by FQSEC at outpatient services within University of Pennsylvania Health System, Philadelphia. Of subjects in whom FQSEC (a levofloxacin-MIC < 4 mcg/mL) were isolated on urine culture, we included only those who met our study criteria of UTIs. Cases were subjects with UTIs caused by **high MIC-FQSEC** (a levofloxacin-MIC ≤ 0.12 mcg/mL) and controls were subjects with UTIs caused by **low MIC-FQSEC**, (a levofloxacin-MIC > 0.12 but < 4 mcg/mL). Cases and controls were compared with regard to demographics, comorbid conditions, and recent use of medications (particularly antibiotics) within the 90 days prior to the UTI onset. We obtained all necessary data from HUP clinical microbiology laboratory database and Penn data store.

Results: Two thousand female subjects with FQSEC-UTIs were included during May 1, 2008 to April 30, 2011. A total of 91.8% (1,836/2,000) had low MIC-FQSEC UTI while 8.2% (164/2000) had high MIC-FQSEC UTI. Mean age was 56.9+/-22.6 years among cases and 57.3+/-22.0 years among controls. Approximately one-fourth of subjects in both groups had at least one underlying diseases. Independent risk factors for high MIC-FQ susceptibility identified by multiple logistic

regression analysis are shown in the table.

Conclusion: In addition to Asian race and having chronic renal diseases, recent use of nitrofurantoin was identified as a risk factor. Since this study was conducted among a relatively healthy population with a low prevalence of recent antibiotic use, we did not have enough power to identify any associations between high MIC-FQSEC and other uncommonly used antibiotics.

1580. Prevalence of antibiotic resistance among P. aeruginosa in US hospitals, 2000-2009

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: *P. aeruginosa* (PA) represents an important cause of severe infection in hospitalized patients. Initially appropriate empiric antibiotic therapy is a key determinant of outcome. Appropriate initial antibiotic selection is predicated on understanding the epidemiology of resistance to commonly used antibiotics either as single agents or as parts of combination regimens. We explored resistance among PA to frequently utilized antibiotic regimens over time in the US.

Methods: We analyzed a nationally representative US-based microbiology database, Eurofins TSN, between years 2000 and 2009. We examined the prevalence of PA's resistance to the following antibiotics: piperacillin/tazobactam (PTZ), ceftazidime (TAZ), imipenem (IMI), or meropenem (MER) alone, and combinations of PTZ+ciprofloxacin (CIP), TAZ+CIP, IMI+CIP, MER+CIP, PTZ+gentamicin (GEN), TAZ+GEN, IMI+GEN, MER+GEN. We evaluated specimens from pneumonia (PNE), blood stream (BSI), urinary tract (UTI) and complicated intra-abdominal (IAI) infections.

Results: Among the 327,912 PA specimens 57.1% were PNE, 35.1% UTI, 5.6% BSI and 2.2% IAI. Overall, the highest prevalence of resistance to single therapy was TAZ (24.8%) and combination IMI+CIP (17.3%). The lowest rate of resistance was to PTZ as a single agent (13.4%) and PTZ+GEN as combination (7.9%). PNE accounted for the highest proportion of resistance to all regimens examined, ranging from 9.5% PTZ+GEN to 29.5% TAZ. Between 2000 and 2009, while resistance rates rose to PTZ (12.4% to 15.0%), IMI (20.8% to 25.2%), MER (19.5% to 24.2%), PTZ+CIP (8.8% to 10.1%), IMI+CIP (14.7% to 18.3%) and MER+CIP (14.9% to 17.4%), those to the other regimens remained stable with some fluctuations.

Conclusion: Resistance among PA to routine anti-pseudomonal regimens is high, with the highest levels observed in PNE. While they have remained stable to some potential regimens, resistance rates to others have increased over the decade examined. The most pronounced rise in PA resistance was to regimens containing carbapenems, irrespective of concomitant fluoroquinolone use. These trends must inform not only empiric treatment of serious infections, but also the approaches to antibiotic stewardship.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1581. Risk Factors for gyrA and parC Mutations in Pseudomonas aeruginosa: A Case-Case-Control Study

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Approximately 25% of *Pseudomonas aeruginosa* (PSA) isolates exhibit phenotypic resistance to fluoroquinolones (FQs). The major mechanism of FQ resistance is modification of target proteins in DNA gyrase and topoisomerase IV, most commonly the *gyrA* and *parC* subunits, respectively. However, multi-drug efflux pumps and other resistance mechanisms may also confer phenotypic FQ resistance. While prior studies have identified risk factors for phenotypic FQ resistance in PSA, risk factors for specific FQ resistance mechanisms may differ and have not yet been described. We sought to determine the association between antibiotic exposure and *gyrA*/*parC* mutations in PSA.

Methods: A case-case-control study design was used to compare two case patient groups (case1 and case2) with controls. Cases were inpatients at an academic medical center from 5/23/08-11/10/09 with a length of stay of at least three days and a first PSA clinical isolate on hospital day three or later. Case1 patients were subjects with an isolate with any *gyrA* or *parC* mutation. Case2 patients were subjects with an isolate with no such mutations. A 10% incident density sample of all patients hospitalized for at least 3 days during the time period were included as controls. Mutations in *gyrA* and *parC* were assessed by PCR amplification and sequencing. Data were collected on prior antibiotic use and potential confounders (i.e., patient demographics,illness severity, time in hospital). Each case group was compared to the control group in separate multivariable models. Identified risk factors were then qualitatively compared between the two models.

Results: Of 298 PSA study isolates, 172 (57.7%) had at least one *gyrA* or *parC* mutation. After controlling for other factors, exposure to non-anti-Pseudomonal antibiotics was a significant risk factor for both cases (Case1 odds ratio (OR): 1.06, 95% confidence interval (CI): 1.02-1.10; case2 OR: 1.05, 95% CI: 1.00-1.10), but the risks did not differ between case groups. Other antimicrobials were not associated with study outcomes.

Conclusion: Exposure to non-anti-Pseudomonal antibiotics is a risk factor for isolation of PSA, but this risk does not differ between the isolates with *gyrA/parC* mutations and those without mutation. This study has a novel focus on risk factors for genotypic resistance.

1582. Acinetobacter baumannii: where is it all coming from?

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

Acinetobacter baumannii (*Ab*) is frequently identified in ICUs and infections lead to high morbidity and mortality due to limited treatment options. Environmental contamination increases the risk of cross transmission. Our goal is to identify where colonized/infected patients (pts) are coming from in our community and to further develop a screening/re-isolation process to prevent potential cross transmission of multi-drug resistant (MDR) *Ab* in high risk settings.

Methods:

We retrospectively reviewed laboratory records from all pts with a positive (+) MDR *Ab* culture from 1/1/2012 to 12/31/2012, defined as resistant to cephalosporins, combination penicillins, fluoroquinolones and/or aminoglycosides. Records were reviewed for trends related to demographics, domicile prior to admission (PTA), admission location in hospital and risk factors for infection. Pts admitted to the MICU, coming from long term care (LTC) were placed in contact isolation; a respiratory (for any organism) plus another cutaneous site (wound, axilla or groin) was tested for *Ab* only. Compliance with the MICU process was unknown; so expansion to areas beyond the MICU has not been implemented.

Results:

Fifty two pts were identified with MDR *Ab* among 66 unique admissions in 2012. Mean age was 51 (range of 23 to 78 years). Thirty nine/66 (59%) admissions involved an ICU stay. Thirty three/66 (50%) pts had a positive culture on or prior to hospital day (HD) 2. The majority of pts 37/66 (56%) came from an extended care facility (ECF); over 60% came from 2 specific LTC facilities, ECF A 17/37 (45.9%) and ECF B 6/37 (16%). In those who came from home, there was a mean of 16 HD prior to the first + culture; all other domiciles ranged from 3.9 to 6 days. The most common co-morbid condition was respiratory; 37/66 (51%) were intubated during admission or had had a tracheostomy PTA. In 2012, 58 pts were screened; 3 respiratory sites were positive for *Ab,* all had correspondingly negative cutaneous sites .

Conclusion:

There is a high incidence of community onset MDR *Ab* in pts coming primarily from 2 ECFs, specializing in chronic ventilator management. This is a population to target screening of respiratory and an alternative secondary screening site to reduce the potential for cross transmission of *Ab.*

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1583. Adult Intensive Care Unit Acquired Nosocomial Multi-Drug Resistant Acinetobacter Infections: Epidemiology, Risk Factors and Genotyping Analysis

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

We aimed in this study to identify risk factors which thought to be influential in the development of nosocomial multi-drug-resistant *Acinetobacter baumanni* infection in adult intensive care units and genotyping of isolates.

Methods:

This research is being a prospective case-control study tried to determine risk factors which are thought to play a role in the development of infection compared with nosocomial *Acinetobacter* infection attacks were determined with 108 cases and 105 patients were in control group with any infection are being followed during the same periods between April 2011-March 2012. The risk factors are identified with analysis of univariate and multivariate logistic regression. Repetitive Extragenic Palindromic-Polymerase Chain Reaction based Diversilab System (Biomerieux, France) was used to research clonal relation between *A. baumanni* strains.

Results:

Age (OR=1.03, 95% CI=1.00 to 1.05, p=0.008), application of mechanical ventilation (OR=5.68, 95% CI=2.53 to 12.72, p=0.0001), tracheotomy (OR=5.29, 95% CI=1.64 to 17.08, p=0.005), percutan enterogastrostomi (OR=9.49, 95% CI=2.41 to 37.27, p=0.001) and a history of using carbapenem (OR=6.02, 95% CI=2.42 to 14.94, p=0.0001) and non-using cephalosporin (OR=0.11, 95% CI=0.02 to 0.49, p=0.004) was found to be an independent risk factor for nosocomial *Acinetobacter* infection. Multiple antibiotic resistance was determined in 94% of the isolates. All isolates were susceptible to colistin. Tigecycline susceptibility was determined as %99,1. Eighty-three of 96 genotyped isolates were in 24 different-cluster. According to genotyping results there was no dominant epidemic clone. Clustering ratio, an indicator of propinquity between clonal isolates, was found to be %86.

Conclusion:

In our study were observed that the clone which have a several number of isolates continued existence of the hospital was approximately 14 months. This data suggests that multi-drug resistant *Acinetobacter* clone can remain for many years in the hospital environment and can transmitted from patient-to-patinet if precautions are not taken. Restriction of implementation of broad-spectrum antibiotics such as carbapenems especially in patients who do not need can reduce the rate of nosocomial infections due to *Acinetobacter baumanni.*

1584. Endemic Cross-transmission of Carbapenem resistant Acinetobacter baumannii in King Fahd Hospital Jeddah: a cohort study

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Infections caused by *Carbapenem resistant Acinetobacter baumannii* (CRAB) are a major concern in king Fahd hospital Jeddah, Saudi Arabia. The magnitude of cross-transmission of the latter organism was never determined at endemic level.

Hypothesis: a predominant genotype might be distributing within our hospital and is responsible for most of the Healthcare Associated Infections reported cases.

Aim: to determine the incidence of CRAB cross-transmission and the predominant genotype.

Methods: the study was conducted from April to December 2010. All patients who were admitted where followed until they acquired CRAB or discharged. Cross-transmission was identified by combining the genetic typing results using Random Amplified Polymorphism DNA (RAPD) and the patients' epidemiological data. Cross-transmission episodes were defined when two or more patients had indistinguishable fingerprint and had been treated in the hospital not more than 3 months apart. The direction of cross-transmission was confirmed if the incriminated pathogen was isolated from the donor before admission of the recipient; otherwise, both patients could potentially be a donor or a recipient.

Results: In total, 102 patients were followed for 5134 patients' days. Out of 104 *Acinetobacter* isolates collected, CRAB counted for (88.5%) 92/104 and 91 isolates were typed. Molecular fingerprinting using RAPD indentified 28 genotypes, of which 25 were sporadic and were unrelated by RPAD. 52 episodes of cross-transmission were identified with an overall incidence of 10 per 1000 patient-days.

Conclusion: On the basis of the genotyping of the isolates, we can conclude that there is a huge distribution of different genotypes of CRAB within the hospital. Cross-transmission beteen patients was determined in 3 genotypes only. Further research is needed to detect the potential source behind the dissemination of CRAB genotypes within our hospital.

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1585. Epidemiology & Risk Factors for Colistin-Resistant Gram-Negative Infections in an Inner City Tertiary Care Hospital

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

The emergence of infections caused by colistin-resistant Gram-negative organisms (CRO) is a major healthcare concern. We performed a retrospective analysis to gain a better understanding of the epidemiology of CRO infections within our own institution.

Methods:

We conducted a retrospective study of patients with positive cultures for CRO (minimum inhibitory concentration, MIC >2 µg/ml) at our institution from October 2007 to March 2012. Microbiology logs and medical records were reviewed to identify study patients and to obtain data including patient demographics, prior healthcare exposure, colistin use, MICs of study isolates, comorbidities, and outcomes 30 days from the time of documentation of the infection.

Results:

98 patients had one or more cultures positive for CRO (total of 150 isolates). The majority (72 %, n=109) of CRO were from genitourinary and respiratory tract specimens, particularly in critical care patients. *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were the most common CRO isolated, with median colistin MICs of 6 µg/ml and 3 µg/ml, respectively. Our population was heterogeneous: black (53%), Hispanic (22%), white (20%), and Asian (4%). Men and women were equally represented; average age was 52 years. 96 patients acquired CRO infections in the hospital setting and 20% (n=20) had documented colistin use within 1 year prior to CRO identification. 75% of patients had indwelling devices in place. Patients had multiple comorbidities, including hypertension in 40% and diabetes mellitus in 37%; 38% were transferred from another healthcare facility. 46 patients were screened for human immunodeficiency virus infection; 13 were positive. Incidence of CRO infections varied from year to year (range 16 to 51/yr). 30% of our patients with CRO died within 30 days of infection; only 30% of patients were discharged home.

Conclusion:

CRO infections are not uncommon in our institution and occur in patients with multiple comorbid conditions, indwelling devices, critical illnesses and healthcare exposure. Heightened vigilance for CRO and a better understanding of the epidemiology and optimal treatment is needed to reduce the significant morbidity and mortality of these infections.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1586. Description of Infections Caused by Polymyxin

Resistant Enterobacteriaceae and Associated Mortality.

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

The emergence of carbapenem-resistance Enterobacteriaceae (CRE) is a major threat to global health. There are few options to treat infections caused by these microorganisms and polymyxins may be the drug of choice, but resistance to polymyxins has been described.

Methods:

We carried out a cohort of patients infected with CRE including polymyxin sensitive and resistant strains, in a 317-bed University Hospital from March 2011 through December 2012. MIC by microdilution for tigecycline, imipenem, polymxyn B, gentamycin and fosfomycin were performed following CLSI. Polymxyn B resistance was defined according with EUCAST Clinical Breakpoint (MIC>2ug/ml). PCR for KPC and PFGE were performed. Data were analyzed using EPIINFO.

Results:

We analyzed 157 patients infected with *K. pneumoniae* in 127 (80.9%) cases, *Enterobacter* spp in 13 (8.3%) patients and other microorganisms in 10.8%. Underlying disease identified were respiratory disease (16.3%), politrauma (14.4%), infectious diseases (10.5%) and others (58.8%). There were 72.1% males, 57.1% were less than 60 years old. Twenty three (14.7%) were bloodstream infection and 57 (36.5%) pneumonia. PCR for KPC was positive in 76.5% strains. Resistance to polymyxin occurred in 26.4% cases, and among this group of patients, 85% received combinated therapy with polymyxin, aminoglycosides, tigecycline , with or without carbapenem. Six clones were identified among polymyxin B resistant strains. The MIC range from 0.25 to >128 ug/mL, summarized in table 1 . The overall mortality of this cohort of infected patients was 62.5% and mortality considered related to infection was 37.5%. There was no difference in mortality between patients with infections caused by polymyxin resistant or sensitive strains (61.5% *versus* 59.3%, p = 0.47).

Table 1: Frequency of MIC (n):

MIC ug/mL	0,25	0,5	1	2	4	8	16	32	64	>128
Nº cases	1	11	56	35	9	5	9	11	2	2

Conclusion:

Infections caused by Carbapenem Resistant *Enterobacteriaceae* were associated with high mortality. In 26.4% cases resistance to polymyxin B was detected, however, resistance was not associated with worse prognosis. We found multiple clones of resistant polymyxins strains.

1587. Colistin and carbapenen resistants isolates of Klebsiella pneumoniae emerging in Brazil: report of ten cases

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: In Brazil, carbapenemase-producing *K. pneumoniae* emerged in 2009, has increased significantly and colistin is one of the therapeutic options. However, there have been sporadic reports of colistin-resistant worldwide, no one described in Brazil. We describe epidemiology and risk factors for mortality associated with the colistin and carbapenem resistants *K. pneumoniae* (CCRKP).

Methods: Retrospective cohort study was conducted at Instituto Central (HC-FMUSP- 933 beds), during the period from Dec-2010 to Dec-2012. Adults patients were included if they had infections due to CCRKP, using diagnostic criteria by CDC. Death was evaluated within 14 and 28 days after the positive culture. The microbiologic identification and the MIC were assessed by Vitek2®. For colisitin the MIC was confirmed by Etest. Resistance to colistin and tigecycline was defined as MIC >2 mg/L (EUCAST). The presence of bla_{KPC} and bla_{CTX-M} genes was determined by PCR.

Results: Total of 10 KPCCR infections (6 male; mean age 44, 5 ± 21 years), 7/10 were allocated at ICU. BSI was documented in 5 patients (2 recurrences), VAP in 3 patients and peritonitis in 2 patients. All patients required CVC and had comorbidities. Cutoffs for scores systems were Charlson ≥ 5, APACHE II ≥ 21 and Pitt ≥ 4 points and were present in 2, 5 and 6 patients, respectively. The mean length of hospital stay was 54 days and before infection acquisition was 20 days. 9/10 received previous antimicrobial therapy. 8 patients received active antibiotic therapy: monotherapy for 4 patients (1 survived) and 4 patients received combined therapy (3 survived). The length of therapy ranged 6-75 days. Mortality rate was 30 and 60% in 14 and 28 days, respectively. The isolates were coresistant to almost all antimicrobials, sparing susceptibility to tigecycline (90%), aminoglycoside (70%) and ciprofloxacin (20%).The genes bla_{KPC} and bla_{CTX-M} were present in 70%. No risk factors for mortality were identified in a univariate analysis.

Conclusion: KPCCR infections affect severe patients admitted in ICU with prolonged stay and exposed to previous antibiotics. Although combined therapy seems to be best, the mortality was high and the appearance of this superbug is worrisome and requires attention of local and public authorities.

1588. Prevalence and Risk Factors for Carbapenem Resistant and Extended

Spectrum Beta-lactamase-producing Bacterial Acquisition in a Thai University Hospital Setting

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Carbapenem resistant (CR) and extended spectrum beta-lactamase (ESBL)-producing bacteria are major emerging pathogens in hospital-acquired infections. Surveillance and monitoring for prevalence of antimicrobial-resistant pathogens are one of important components of infection control efforts.

Objective: We aimed to determine prevalence and risk factors for CR and ESBL-producing bacterial acquisition among patients who were admitted in medical wards in a university hospital setting.

Methods: Perianal swab cultures were performed in all patients who were admitted in the medical intensive care unit (ICU) between November 2010 and April 2011. Additional cultures, such as tracheal suction, urine, and wound were performed in all patients with related medical devices/condition. Factors for CR and ESBL-producing bacterial acquisition were determined by logistic regression analysis.

Results: A total of 89 patients who were admitted in the ICU for more than 48 hours had surveillance culture performed. Of all, 44 (49.4%) patients were male, mean (SD) age was 60.9 (16.7) years, and 52.8% patients were hospitalization in another ward before ICU admission. Fifty-four (60.7%) patients had positive culture results for CR or ESBL-producing bacteria. The common isolated organisms were ESBL-producing *Escherichia coli* (66.7%), followed by CR-*Acinetobacter baumannii* (29.6%). Patients with CR or ESBL-producing bacterial acquisition were more likely to have a longer duration of hospitalization before ICU admission (8.6 days vs. 3.6 days, p=0.010), receive antibiotic previously (51.8% vs. 28.6%, p=0.030), prior expose to chemotherapy (25.9% vs. 2.9%, p=0.005), use devices (40.7% vs. 20%) or mechanical ventilation (25.9% vs. 5.7%, p=0.015). Higher mortality rate at 14 days was found in patients with CR or ESBL-producing bacterial acquisition (42.6% vs. 25.7%, p=0.105). By multivariate analysis, only age (OR 3.03, >60 years vs. <60 years; 95% CI 1.08-8.4, p=0.034) was an independent factor associated with CR or ESBL-producing bacterial acquisition.

Conclusion: High prevalence of CR and ESBL-producing bacteria acquisition is determined in our hospital setting. Regular surveillance and monitoring system for drug-resistant organisms may be crucial, especially in patients with some particular factors, for controlling drug resistant problem.

1589. Statewide spatial distribution of catheter-related bloodstream infection caused by multidrug-resistant organisms in intensive care units in São Paulo State, Brazil

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

Multidrug-resistant organism incidence is increasing worldwide. The objective of this work is to describe spatial distribution of the incidence of catheter-related bloodstream infection (CLABSI) caused by MDRO in intensive care units (ICU) in 2011 in Sao Paulo, Brazil.

Methods:

Study area

The State of São Paulo is located in southeast of Brazil with 41.262.199 inhabitants in 2010, yearly *per capita* income US$ 5,400.00.

Epidemiological data

This state implemented a nosocomial infection surveillance system in 2004 and currently 357 ICUs send data to the system, including incidence of CLABSI per 1000 patients-day and susceptibility data concerning MDRO. This study includes 321 ICUs with five or more beds in 2011.

Spatial data

Participant hospitals addresses were retrieved from infection control branch of health state department and were geocoded using Google Earth™ version 7.0.3.8542. A database was created using ArcGIS 10.0 (ESRI Corp., Berkeley California). Incidence rates were divided into quartiles and presented graphically in maps. Spatial dependency was tested by Moran index from a neighbourhood matrix obtained using GEODA™software. Matrix was generated using an eight nearest neighbours parameter and probability was calculated on a 999 permutation basis.

Results:

Maps were created for each MDRO and their incidences represented. The results of Moran index and the significance of its probability are presented in Table1.

Table1.Spatial dependency analysis of incidence of catheter-related bloodstream infections caused by multi-resistant organisms per 1000 patients-day in the State of Sao Paulo, Brazil in 2011

MDRO	Moran index	p value
Acinetobacter spp. (CR)	0.03	0.10
Pseudomonas aeruginosa (CR)	0.08	<0.05

Escherichia coli (CEF-R)	0.006	0.29
Klebsiella pneumoniae (CR)	0,017	0.18
MRSA	0.04	0.07
Enterococcus sp (VRE)	0.03	0.09

CR: carbapenem-resistant; CEF-R: cephalosporin-resistant; MRSA: methicillin-resistant S. aureus; VRE: vancomycin-resistant entorococci

Conclusion:

Carbapenem-resistant *Pseudmononas aeruginosa* was the only pathogen that showed a significant spatial dependency. Reasons for this dependency should be explored in further studies. This model may be a promising tool the evaluate associations between resistance, antimicrobial use and demographic data.

1591. Fosfomycin Resistance is Associated with Receipt of Incorrect Empiric Therapy for Multidrug Resistant Uropathogens

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Increasing rates of multi-drug resistant (MDR) and extended-spectrum beta-lactamase (ESBL) uropathogens have resulted in few oral choices for empiric treatment of UTI. Fosfomycin (FOS) has been shown in previous surveys to be active against 85-100% of MDR pathogens. However routine susceptibility testing is not available and little is known about risk factors for predicting FOS resistance, which could result in choosing incorrect empiric therapy. We sought to determine the prevalence of and risk factors for fosfomycin-resistant (FOS-R) ESBL uropathogens from 2011-2013.

Methods: We evaluated a collection of ESBL uropathogens from 2 VA hospitals for FOS-R using disk diffusion and standard published breakpoints. The electronic health record was reviewed to capture risk factors, antimicrobial use, and outcomes.

Results: Among 91 ESBL uropathogens, 17 (18.7%) were FOS-R. Klebsiella was more likely to be FOS-R than E. coli (46% vs. 6.3%, p <.001). Chart review was performed on 62 unique episodes. FOS-R was independently associated with urinary catheterization (p=0.04) and prior urinary tract infection (p=0.02). Compared to patients with FOS-S uropathogens, patients with FOS-R uropathogens were more likely to receive IV therapy with a beta-lactam or carbapenem (75% FOS-R vs. 37% FOS-S, OR = 5.1, p = .02) and to receive inactive empiric therapy (62% vs. 32%, OR = 3.3, p =0.07). Co-resistance with FOS was present in 20% (10/50) of fluoroquinolone-R ESBL uropathogens, 16% (6/37) of bactrim-R uropathogens, and 35% (8/23) of nitrofurantoin-R uropathogens. Of the 11 ESBL isolates resistant to all 3 oral agents (FQ, TS, NF), 9 remained susceptible to FOS. Only 2/62 (3.2%) ESBL uropathogens were resistant to all oral agents.

Conclusion: FOS remains active against a majority of ESBL uropathogens, although our rates of resistance are higher than previous studies. Co-resistance with oral agents varied and was greatest with nitrofurantoin resistance. The majority of uropathogens remained susceptible to at least one available oral agent. FOS-R can be anticipated in patients with Klebsiella, previous UTI, or urinary catheterization. Inactive empiric therapy is more likely among patients with FOS-R and warrants further investigation.

1592. Fosfomycin Minimum Inhibitory Concentrations in Multi-Drug Resistant Organisms of Uncomplicated Urinary Tract Infections

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

An increasing number of urinary tract infections due to multi-drug resistant (MDR) bacteria have been observed in East Orange General Hospital located in East Orange, NJ and in St. Mary’s Hospital located in Passaic, NJ, which have left limited options for treatment. Fosfomycin has been reported to retain in-vitro activity against some MDR organisms. Over the course of 4 months, the minimum inhibitory concentration (MIC) of fosfomycin for various organisms has been recorded via E test (BioMerieux, Durham, NC). A summary of fosfomycin activity for 21 MDR isolates has been reported.

Methods:

All urine samples were tested against standard anti-microbial agents on the Vitek-2 panel (BioMerieux, Durham, NC). Fosfomycin E tests were utilized on the MDR bacterial isolates present in urine samples to identify their susceptibility if the isolate was reported to be MDR. The results were prospectively reviewed between December 2012-March 2013 and then tabulated. The dates of isolation, source site, and MICs for fosfomycin were recorded for each organism.

Results:

21 isolates were included in the analysis. 11 isolates were *Klebsiella pneumoniae* (KP), 8 were *Escherichia coli* (EC), 2 were *Enterococcoccus faecalis* (ES) 8 of the 11 KP isolates were sensitive to tigecycline and 2 of the 11 KP isolates were sensitive to gentamicin. Out of the 8 EC isolates 5 were sensitive to tigecycline, 5 were sensitive to nitrofurantoin, and 6 were sensitive to gentamicin. An MIC of <64 ng/mL suggests the organism is susceptible to fosfomycin. 10/11 KP isolates, 8/8 EC, and 1 ES had MICs less than 64 ng/mL.

Conclusion: In this study, fosfomycin demonstrated in vitro activity against several MDR organisms and may offer a viable

alternative for treatment of highly MDR organisms isolated from the urinary tract. Additional studies are warranted to explore the clinical impact of fosfomycin in this patient subset.

1593. Prevalence and Risk Factors for Extended Spectrum Beta-Lactamase Producing Organisms among Patients with Complicated Urinary Tract Infections

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Clinically correlated data on ESBL isolates in the Philippines are limited and outdated. We aimed to determine the prevalence, risk factors and genotype of ESBL-producing isolates among patients with complicated urinary tract infection (cUTI) and their impact on clinical outcome in a tertiary government hospital.

Methods: We prospectively included patients with cUTI admitted from 2011-12 and collected data on demographic and clinical outcome. The urine isolates were screened for ESBL as outlined in the CLSI. Susceptibility patterns were confirmd using VITEK 2. Multiplex PCR and sequencing were done to determine the prevalent genotype.

Results: Of 170 patients analyzed, 30% had ESBL-producing isolates. *E. coli* (43%) and *K pneumoniae* (43%) were the most common organisms. On univariate analysis, risk factors significantly associated with ESBL development were transfer from another facility (OR 4.6; 95% CI 1.3-16.4), hospitalization within the past 3 months (OR 2.8; 95% 1.3-6.0), antibiotic use in the past 3 months (OR 3.8; 95% CI 1.9-7.6), presence of indwelling catheter (OR 2.9; 95% CI 1.3-6.8), nosocomial UTI (OR 4.6; 95% CI 2.3-9.2) and duration of hospital stay (OR 1.04; 95% CI 1.01-1.06). On multivariate analysis, history of antibiotic use (OR 2.3; 95% CI 1.0-5.1) and nosocomial UTI (OR 2.7; 95% CI 1.2-6.2) remained significant. On subgroup analysis of antibiotics used, previous use of third generation cephalosporin was significant (OR 5.0; 95% CI 1.3-19.1). The phenotypes identified were: ESBL + carbapenemase (7.8%), ESBL + cephamycin impermeability (7.8%) and ESBL + high level cephalosporinase AmpC (11.8%). The most common genes detected were CTX-M (37%) followed by OXA and TEM. No NDM was detected; one had KPC and two with VIM gene. Sensitivity to carbapenem was 100% for ESBL producing *E. coli* and 99% for *K. pneumoniae*. No significant difference in mortality among ESBL-negative and ESBL-positive patients was found (9.2% vs 9.8%).

Conclusion: *E. coli* remained the most common pathogen in cUTI but with ESBL emergence at 30%. Modifiable risk factors independently associated with ESBL development were previous exposure to third generation cephalosporin and nosocomial UTI. Multiple resistance mechanisms were seen among the ESBL-producing isolates. Strategies for antibiotic stewardship and infection control are clearly needed.

1594. Multidrug Resistant Enterobacteriaceae in a Suburban Community Teaching Hospital; A Retrospective Analysis

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: There has been a sharp increase in infections caused by multidrug resistant (MDR) gram-negative organisms, particularly in tertiary care facilities. High rates of colonization and infection caused by these bacteria pose challenges for both therapy and prevention, but little is known about the scope of resistance in community settings.

Methods: We reviewed the records of patients seen at a suburban community teaching hospital (both inpatients and outpatients) who had one or more cultures positive for MDR Enterobacteriaceae in 2008 and 2012. We examined culture data for three different resistance patterns: ESBL, AmpC and Carbapenem-resistant Enterobacteriaceae (CRE) using standard definitions.

Results: In 2012, 210 patients had positive cultures for MDR- Enterobacteriaceae at the Metrowest Medical Center. Since 2008, there was a doubling of patients who had infection or colonization with ESBL producing organisms. The majority of ESBL and AmpC producers were Escherichia coli, and all isolates of CRE except one were Klebsiella pneumonia. More than 60% of the patients came from the community, although all of the patients with carbapenem resistance were from nursing homes. The age range was 9-97. Although the majority of patients had one or more co-morbidities identified, 17% of patients with ESBL had no significant underlying diseases. Five percent of the patients with MDR gram-negative bacilli had bacteremia and three quarters of the isolates were from urine. In 2008, 57% of patients with carbapenem resistance presented with severe sepsis or required an ICU admission, and the 30 day mortality was 85%, declining to 0% in 2012. Likewise, mortality in patients with ESBL declined from 15% to 3%, and no patients infected with an AmpC resistance pattern died of infection.

Conclusion: MDR infections caused by gram-negative bacilli are increasing in community hospital settings, and occur in patients with significant underlying morbidity and in-hospital mortality. This has important implications, not only for infection control practices, but for initial antibiotic selection in patients who present with severe infection. A significant number of patients with infections caused by ESBL-producing organisms acquire infection in the community and are healthy, presenting new challenges for management.

1595. In Vitro Activity of Ertapenem and Comparators against Aerobic Gram-negative Intra-Abdominal Infection (IAI) Pathogens in the USA—SMART 2012

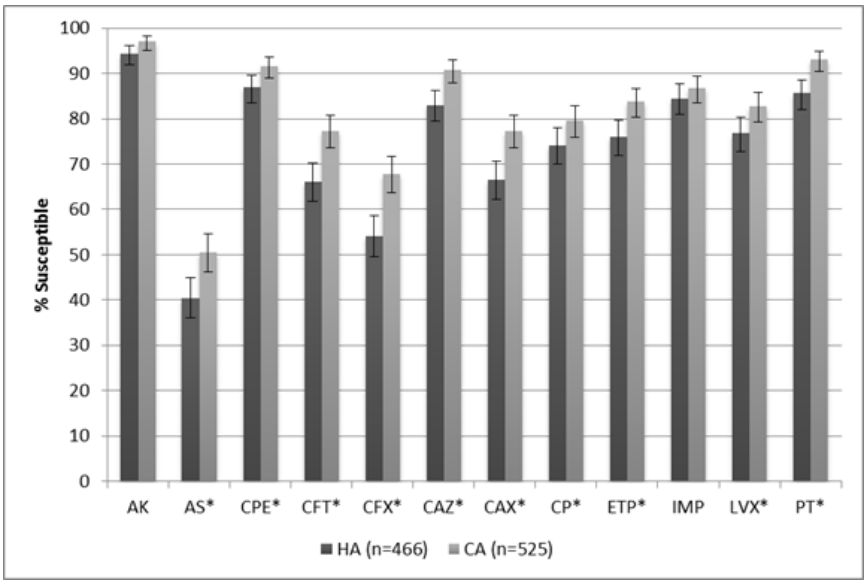
Part of Session: 188. Multidrug-Resistant Gram Negative Rods

ROBERT BADAL, B.S.[1], SIBYLLE LOB, MD, MPH[1], DARYL HOBAN, PHD[1], SAMUEL BOUCHILLON, MD[1], MEREDITH HACKEL, PHD, MPH[1], DOUGLAS BIEDENBACH, BS[1], STEPHEN HAWSER, PHD[2] and IAN MORRISSEY, PHD[2]; [1]International Health Management Associates, Inc., Schaumburg, IL, [2]IHMA Europe Sàrl, Epalinges, Switzerland

Background: The IDSA and the SIS updated guidelines for IAI therapy in 2010. The Study for Monitoring Antimicrobial Resistance Trends (SMART) is a longitudinal surveillance study that has tracked the *in vitro* activity of drugs commonly used to treat IAI since 2002. This report summarizes *in vitro* activity of amikacin (AK), ampicillin-sulbactam (AS), cefepime (CPE), cefotaxime (CFT), cefoxitin (CFX), ceftazidime (CAZ), ceftriaxone (CAX), ciprofloxacin (CP), ertapenem (ETP), imipenem (IMP), levofloxacin (LVX), and piperacillin-tazobactam (PT), against aerobic gram-negative bacilli (GNB) isolated in 2012 from IAI in the US.

Methods: 12 laboratories in the US each collected up to 100 consecutive isolates of GNB from IAI in 2012 for a total of 991 isolates. Isolates were sent to a central laboratory for confirmation of identification; ESBL status and broth microdilution susceptibility were determined using CLSI broth microdilution. IAI was defined as hospital-associated (HA) or community-associated (CA) if cultured ≥48 hours or <48 hours post admission, respectively. Statistical significance was determined using Fisher's exact test.

Results: The 2 most prevalent species, *E. coli* and *K. pneumoniae*, accounted for 55% of all isolates, and had ESBL rates in HA/CA of 8%/7% and 15%/7%, respectively. 97% of 794 *Enterobacteriaceae* were ETP susceptible (S). Susceptibility (with 95% confidence limits) of all isolates combined, using breakpoints appropriate for each species (0% S assumed for species with no breakpoints for any given drug) is summarized by HA and CA, below; asterisks by drug names indicate a significant difference ($p<0.05$) between HA and CA values.



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Conclusion:

· ESBL rates in IAI in the US are relatively unchanged from earlier SMART reports, and remain much lower than reported in most countries, leading to higher levels of susceptibility to cephalosporins and fluoroquinolones than typically seen internationally.

· All study drugs except AK and IMP had significantly lower %S in HA than in CA.

· AK (97.8%) and ETP (97.2%) were the most active vs. *Enterobacteriaceae*, while AK (86.2%) and CAZ (78.7%) were the most active vs. non-*Enterobacteriaceae*.

· SMART data can be useful to help guide evolving IAI treatment guidelines to reflect resistance trends.

1596. Epidemiology and Susceptibility of Pathogens from Hospital- and Community-Associated Urinary Tract Infection in Latin America: SMART 2010-2012

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: The Study for Monitoring Antimicrobial Resistance Trends (SMART) has monitored gram-negative pathogens (GNP) from urinary tract infections (UTI) since late 2009. To help with empiric therapy decisions in Latin America (LA), this report summarizes occurrence and susceptibility of pathogens (including extended-spectrum β-lactamase [ESBL] producers) in hospital- (HA) and community-associated (CA) UTI in 2010-2012 in this region.

Methods: Labs in 11 countries collected up to 50 consecutively isolated GNP per year from hospitalized patients with UTI. Susceptibility and ESBL phenotypes were determined by microdilution per CLSI guidelines for 3,581 GNP. A UTI was defined as HA or CA if cultured ≥48 hours or <48 hours post admission, respectively.

Results:

The top 10 species (comprising 97% of all isolated species) are shown below with ESBL and susceptibility rates for selected drugs. Values ≥90% are bolded.

	n	% ESBL	% Susceptible

					Amikacin		Cefotaxime		Ceftazidime		Cipro		Ertapenem		Pip-Tazo	
Row Labels	HA	CA	HA	CA	HA	CA	HA	CA	HA	CA	HA	CA	HA	CA	HA	CA
E. coli	978	1244	32	22	**96**	**98**	65	76	72	80	47	57	**99**	**100**	88	**92**
K. pneumoniae	291	245	48	35	86	89	43	61	46	64	46	59	87	**93**	58	73
P. aeruginosa	129	87			66	53	NB	NB	62	60	52	36	NB	NB	59	61
P. mirabilis	98	95	14	8	**96**	**97**	81	86	**96**	**92**	77	81	**100**	**100**[1]	**94**	**97**
E. cloacae	61	31			87	**90**	38	45	46	45	62	45	79	87	66	65
A. baumannii	32	19			25	21	9	5	16	26	13	16	NB	NB	13	16
M. morganii	25	17			**96**	**100**	72	71	**92**	76	56	65	**100**	**100**	**100**	**100**
E. aerogenes	21	17			**90**	**100**	57	59	67	65	81	**94**	**95**	**100**	76	82
C. freundii	21	16			**100**	**94**	52	69	71	75	52	63	**95**	**94**	76	**94**
S. marcescens	21	13			86	**100**	62	85	71	**92**	81	85	**90**	**100**	71	**100**
Top 10 species[2]	1677	1784			**90**	**93**	55	69	66	76	50	57	87	**93**	78	87

[1] Rounded up (99.6%).

[2]Susceptibility was calculated for 10 top species combined; 0% susceptibility assumed for species with no breakpoints for any given drug.

NB=No breakpoint.

Conclusion:

- ESBL rates were higher in HA than CA infections in Latin America, but even CA rates were high compared to global rates reported previously.
- Susceptibility was almost always lower in HA UTI GNP.
- Due to high ESBL rates in the two most frequently isolated UTI GNP, options for empiric UTI therapy are limited, especially in HA infections. Of the drugs studied, only amikacin was active against ≥90% of both HA and CA pathogens, and ertapenem (and imipenem; data not shown) against ≥90% of CA pathogens.

1597. Epidemiology of ESBL-Producers in Intra-Abdominal Infections in Adults in ICU versus non-ICU wards in North America: SMART 2010-2012

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

SIBYLLE LOB, MD, MPH[1], **ROBERT BADAL, B.S.**[1], DARYL HOBAN, PHD[1], SAMUEL BOUCHILLON, MD[1], MEREDITH HACKEL, PHD, MPH[1], DOUGLAS BIEDENBACH, BS[1], STEPHEN HAWSER, PHD[2] and IAN MORRISSEY, PHD[2]; [1]International Health Management Associates, Inc., Schaumburg, IL, [2]IHMA Europe Sàrl, Epalinges, Switzerland

Background: ICU admission has been identified as a risk factor for extended-spectrum β-lactamase (ESBL) infections, especially in *Klebsiella* .This report from the Study for Monitoring Antimicrobial Resistance Trends (SMART) summarizes the occurrence of ESBL producers in IAI in 2010-2012 in North America (NA), comparing ICU and non-ICU wards.

Methods: 29 sites in the US and Canada collected up to 100 consecutively isolated gram-negative pathogens (GNP) from adults with IAI per year. Susceptibility and ESBL phenotypes were determined by microdilution per CLSI and plate manufacturer guidelines for 4,249 GNP. An IAI was defined as hospital-associated (HA) or community-associated (CA) if cultured ≥48 hours or <48 hours post admission, respectively. ESBL rates were compared with the Fisher exact test.

Results:

Escherichia coli, *K. pneumoniae, Proteus mirabilis*, and *K. oxytoca*comprised 64% of all IAI GNP. Prevalence rates of each species and ESBL rates are shown below:

	ICU wards			Non-ICU wards		
	HA	**CA**	**Total**	**HA**	**CA**	**Total**
All organisms						
n	471	343	814	1640	1795	3435
E. coli						
n	167	136	303	623	743	1366
Prevalence (%)	35.5	39.7	37.2	38.0	41.4	39.8

ESBL+ rate (%)	12.0*	2.9*	7.9	10.9	7.4	9.0
K. pneumoniae						
n	77	66	143	271	331	602
Prevalence (%)	16.3	19.2	17.6	16.5	18.4	17.5
ESBL+ rate (%)	11.7	9.1	10.5	11.1	7.3	9.0
P. mirabilis						
n	15	14	29	44	86	130
Prevalence (%)	3.2	4.1	3.6	2.7	4.8	3.8
ESBL+ rate (%)	0	0	0	6.8	1.2	3.1
K. oxytoca						
n	11	15	26	61	77	138
Prevalence (%)	2.3	4.4	3.2	3.7	4.3	4.0
ESBL+ rate (%)	9.1	6.7	7.7	4.9	5.2	5.1

* HA and CA significantly different ($p<0.05$).

Note: Differences between ICU and non-ICU wards not significant ($p>0.05$).

Conclusion:

- While higher ESBL rates in ICU than non-ICU wards have been reported elsewhere, our results for IAI GNP showed no significant differences in NA.
- Clearer differences are seen between HA and CA infections, with ESBL rates tending to be higher in HA IAI in both ICU and non-ICU settings (but only statistically significant for *E. coli* in ICUs).
- These results concur with a 2004 CDC National Nosocomial Infections Surveillance report with similar rates of *K. pneumoniae* and *E. coli* resistant to 3rd gen. cephalosporins in US ICU and non-ICU wards. Although ICU admission has been reported to be a risk factor for ESBL infection, our data suggest that may not be the case in NA.

1598. Epidemiology of CTX-M-type extended-spectrum ?-lactamase (ESBL)-producing Escherichia coli among older adults

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background : ESBL-*E. coli* (ESBLEC), especially CTX-M-type ESBL-*E. coli* (CTXMEC) have emerged as a major clinical problem worldwide, and in many locales have spread to the community. The epidemiology of the isolation of CTXMEC among older adults, which include >10% of US population, is not well known. We conducted a case-control study to identify independent risk factors for recovery of CTXMEC in older adults, in a large U.S. medical center located in southeast Michigan.

Methods : Unique older adults (≥ 65 year old) with clinical ESBLEC isolation during the study period (2/2010 –7/2011) were included. PCR analysis for the detection of CTX-M-beta-lactamase genes was conducted. Patients with CTXMEC whose detailed medical records were available (cases) were matched to uninfected controls (≥ 65 year old) in a 1:1 ratio.

Results : Eighty-seven CTXMEC cases (72 [82.8%] CTX-M-15-type) were identified from urine (n=65); sputum (n=9); wounds (n=7); and blood (n=5). These cases were matched to 87 uninfected controls. The mean age of the study cohort was 78.1±8.7 years and 85 (48.9%) were male. Independent risk factors for the isolation of CTXMEC were determined (Table). In-hospital mortality was similar between two groups (7.1% vs 7.0%); 3 month mortality rates were higher in CTXMEC group than controls (20.3% vs 11.5%, $p=0.05$). Median total length of hospital days was greater among CTXMEC cases than controls (9 [IQR: 6-15] vs 5 [3-8], $p<0.001$). In 65 (74.7%) cases, CTXMEC was present at the time of hospital admission (isolated within 48 hours of admission). Nine (10.3%) of CTXMEC cases did not have recent health care contact; of these, 5 also did not have recent antibiotic exposure.

Conclusion : Non-home residence, multiple comorbidities, and catheter use were independently associated with isolation of CTXMEC among older adults. Antimicrobial exposure was not a risk factor for the CTXMEC isolation. CTXMEC are prevalent outside hospitals among older adults in the US.

Table. Multivariate analysis of risk factors for the isolation of CTXMEC among older adults[A]		
Variable	CTXMEC cases vs uninfected controls	
	Odds ratio	

	Odds ratio (95% CI)	P value
Charlson combined comorbidity index (≥5)	13.10 (1.62-105.70)	0.016
Indwelling urinary catheter	3.47 (1.29-9.30)	0.013
Non-home residence	3.16 (1.10-9.10)	0.033
[A] Controlled for history of urinary tract infection		

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1599. The Effect of a Hospital-Wide Urine Culture Screening Intervention on the Incidence of Extended-Spectrum Beta-Lactamase (ESBL)-Producing Escherichia coli and Klebsiella Species

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Optimal infection control strategies for limiting the transmission of extended-spectrum beta-lactamase-producing *Escherichia coli* and Klebsiella species (ESBL-EK) in the hospital setting remain unclear. The objective of this study was to evaluate the impact of a urine culture screening strategy on the incidence of ESBL-EK.

Methods: This prospective quasi-experimental study was conducted at two intervention hospitals and one control hospital within a university health system from January 2005 to February 2009. The intervention consisted of screening of all clinical urine cultures with *E. coli* or *Klebsiella* spp for ESBL-EK. Patients determined to be colonized or infected with ESBL-EK were placed in a private room with contact precautions. The primary outcome was nosocomial ESBL-EK incidence in non-urinary clinical cultures (cases occurring >48 hours after admission). Changes in monthly ESBL-EK incidence rates were evaluated using mixed effects Poisson regression models, with adjustment for institution-level characteristics (e.g., average length of stay, total admissions).

Results: The overall clinical incidence of ESBL-EK increased from 1.42 per 10,000 patient-days in the pre-intervention period to 2.16 per 10,000 patient-days in the post-intervention period. The incidence of community-acquired ESBL-EK (cases occurring ≤48 hours after admission) increased nearly three-fold over the study period, from 0.33 cases per 10,000 patient-days in the pre-intervention period to 0.92 cases per 10,000 patient-days in the post-intervention period (P<0.001). On multivariable analysis, the intervention was not significantly associated with a reduction in nosocomial ESBL-EK incidence (incidence rate ratio, 1.38; 95% confidence interval, 0.83-2.31; P=0.21).

Conclusion: Universal screening of clinical urine cultures for ESBL-EK did not result in a reduction in nosocomial ESBL-EK incidence rates, most likely due to increases in importation of ESBL-EK cases from the community. Further studies are needed on elucidating optimal infection control interventions to limit spread of ESBL-producing organisms in the hospital setting, including the role of active surveillance screening and effectiveness of contact precautions.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1600. Sharing of Escherichia coli Sequence Type ST131 and other E. coli among Household (HH) Members

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: *E. coli* ST131, a typically fluoroquinolone-resistant (FQ-R) and/or extended-spectrum beta-lactamase (ESBL)-positive extraintestinal pathogen, has emerged recently worldwide. Transmission of *E. coli* among HH members is well documented, but only anecdotally for ST131. We systematically assessed for intestinal co-colonization among HH members of patients with FQ-R *E. coli* clinical isolates.

Methods: Veterans with FQ-R *E. coli* clinical isolates and their HH members (humans and pets) underwent initial and follow-up stool cultures for *E. coli* (FQ-R and FQ-S). Isolates were tested for ST131 status and compared with one another and the index clinical isolate according to RAPD profiles. One representative per unique RAPD profile per sample underwent PFGE analysis.

Results: 10 HHs of veterans with FQ-R *E. coli* clinical isolates (of which 7 [70%] were ST131) were studied. The veteran's index strain was documented in another HH member for 6 HHs (60%), at similar frequency for ST131 (4/7, 57%) and non-ST131 (2/3, 67%) strains. Additionally, sharing of a FQ-S strain was documented in 4 HHs (40%). Although initial strain sharing involved mainly index patients and spouses, in one HH two sons shared a FQ-S strain, and in another HH all members (index patient, spouse, and dog) shared the veteran's ESBL-positive recurrent UTI ST131 strain. Six (60%) of the 10 households continued to share index strains (4 ST131, 2 non-ST131), 10 (100%) index patients still carried their index strains, and 2 (20%) shared the FQ-S strains (in one family, all household members including index patient, son and dog) in their stools on follow-up cultures.

Conclusion: HH members of veterans with FQ-R *E. coli* clinical isolates (70% of which are ST131) are frequently co-colonized with the index strain or other *E. coli*, regardless of ST131 status. Within-HH transmission may facilitate dissemination of resistant *E. coli* and contribute to recurrent UTI.

1601. Surveillance for Klebsiella pneumoniae Carbapenemase (KPC)-Producing Enterobacteriaceae

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Carbapenem-resistant Enterobacteriaceae (CRE) have emerged as a public health threat. CRE infections are associated with higher morbidity and mortality than carbapenem-susceptible organisms. CRE spread in healthcare (HC) settings has occurred. In 2009, the MN Dept. of Health (MDH) detected a KPC-producing CRE and initiated surveillance for CRE.

Methods: Voluntary reporting of CRE is conducted statewide; active, lab-based surveillance occurs in the 2 most populous counties. During 2011-2012, CRE isolates were submitted to MDH and underwent PCR testing for bla_{KPC}. If positive, case medical records were reviewed.

Results: 118 CRE isolates were submitted. 50 incident isolates (21, 2011; 29, 2012) from 46 patients were bla_{KPC} positive; 13 patients had recurrent isolates of the same species within 1 year of initial culture. *K. pneumoniae* (24) and *E. cloacae*(23) were the most common organisms. Urine (26) was the most common culture source followed by sputum (7), wound (5), blood (4), other respiratory (4), peritoneal (2), bone (1), and other (1).

48 medical records were available for review. Median age was 58 yrs (range 6 mo-91 yrs); 54% were male and 44% (21/48) were active surveillance area residents. 98% had a co-morbidity (diabetes [24] and neurological condition [22]). All cases had an invasive device (74%: urinary catheter [28]; CVC [16]; or other invasive device [24]) within the 2 days prior to culture and/or a HC exposure (93%: hospitalization [38]; surgery [23]; dialysis [8]; or LTCF resident [22]) within the prior year.

65% (31/48) had a known hospitalization within 30 days of culture; 55% of these required ICU care and, median LOS was 16 (range 1-238) days. In-hospital mortality was 19%. 64% of surviving cases were discharged to LTCF or LTACH. Other cases were from LTACH (7), outpatient (7), or LTCF (3).

Conclusion: KPC-producing CRE has emerged in MN; *K. pneumoniae* and *E. cloacae* are the most common organisms. All cases had HC–associated risk factors. Many had significant morbidity including intensive care, and a fatality rate of nearly 20% among hospitalized cases. Notably, 2/3 of hospitalized cases were discharged to another facility, highlighting the importance of communication and implementation of infection prevention measures. Ongoing surveillance will be important to determine trends and assess prevention measures.

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1602. Characterization of Carbapenem-resistant Enterobacteriaceae Isolates Collected through the Emerging Infections Program Network

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Preventing carbapenemase-producing (CP), carbapenem-resistant *Enterobacteriaceae* (CRE) transmission is a priority, but determining CP-CRE is complicated because phenotypic testing done in clinical labs does not distinguish CP-CRE from other resistance mechanisms. We assessed a CRE surveillance definition by re-testing isolates identified as CRE in clinical labs using reference susceptibility methods.

Methods: During 12/2011-2/2013, 4 Emerging Infections Program (EIP) sites submitted *Escherichia coli, Enterobacter spp.,* and *Klebsiella spp.* sterile sites or urine isolates that met the EIP CRE definition (carbapenem nonsusceptible (NS) [excluding ertapenem] and resistant to all 3rd generation cephalosporins tested) by minimum inhibitory concentration (MIC) results, as tested on local lab's automated testing instruments (ATI). CDC performed reference susceptibility testing by broth microdilution, modified Hodge test, and carbapenemase polymerase chain reaction.

Results: Of 47 isolates, 15 (32%) did not meet the CRE definition after reference testing. The proportions of *E. coli* (3/7, 43%) and *Enterobacter* (11/26, 42%) not meeting the case definition were similar, but was lower for *Klebsiella* (1/14, 7%). Isolates not meeting the definition were more likely to have initially tested NS to only 1 carbapenem compared to those that met the definition (13/15 vs. 17/32, p=.03) on the ATI. ATI MIC results for isolates not meeting the definition were generally ≥ 2 doubling dilutions higher when compared to the reference method MIC. Isolates that met the definition were significantly more likely to be CP-CRE (20/32 vs. 0/15; p<0.001). Modifying the definition to require resistance, rather than NS, to any carbapenem tested (including ertapenem) eliminated 9/15 isolates the CRE definition after reference testing, without excluding any CP isolates.

Conclusion: Many isolates meeting the EIP CRE definition at local labs did not meet the definition following reference testing. This issue was common among *Enterobacter spp.* and *E. coli*; ATI MICs were frequently ≥2 doubling dilutions higher, suggesting the difference might not be due to testing variation. A CRE definition change requiring resistance, to any carbapenem tested might improve the use of this definition for regional or national surveillance.

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1603. Variation in Definitions and Isolation Procedures for Multidrug-resistant Gram-negative Bacilli: a Survey of the SHEA Research Network

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: The emergence of multidrug-resistant Gram-negative bacilli (MDR GNB), including *Klebsiella*, *Acinetobacter* and *Pseudomonas*, has been a major challenge for healthcare facilities. There is little guidance as to how to isolate patients harboring these organisms.

Methods: We conducted an online cross-sectional survey of members of the SHEA Research Network (SRN) during Nov 2012-Feb 2013 to assess infection control practices regarding MDR GNB. The survey included definitions and infection control procedures related to MDR GNB.

Results: Of 200 SRN members, 69 responded (35% response rate), representing 26 states and 15 countries. Participants varied regarding definitions of "multidrug resistant," with 15 unique definitions for *Acinetobacter*, 17 for *Pseudomonas*, and 23 for *Enterobacteriaceae* species. The most common definition for each was resistance to ≥3 classes of antimicrobials (25-43%). Substantial variation existed in isolation practices for patients with MDR GNB (Table). Most (≥80%) facilities reported experience with each MDR-GNB isolate and 78% have encountered pan-resistant MDR-GNB (ie, susceptible only to colisitin). Approximately 20% of facilities did not isolate for MDR *Pseudomonas* or *Acinetobacter* and > 50% allowed removal of isolation for patients with known MDR GNB.

Conclusion: Facilities vary significantly in their approach to prevent MDR GNB transmission. Inconsistent definitions of MDR may hinder communication during patient transfers. Many (25- 43%) hospitals remove isolation for MDR GNB without requiring negative cultures and 17-26% do not isolate certain MDR GNB at all. Inconsistent definitions and use of isolation practices may be contributing to the ongoing epidemic of MDR GNB.

	ESBL %	CRE %	MDR Pseudomonas %	MDR Acinetobacter %
Use isolation for patients with organism	73.9	94.2	79.7	82.6
Duration of isolation:				
During active illness/until completion of antibiotics	9.3	10.0	10.7	9.8
Duration of hospitalization:	29.6	15.0	32.1	32.8
Until negative surveillance cultures obtained	31.5	33.3	33.9	30.4
Indefinitely	33.3	46.7	30.4	31.1
Isolation of readmitted patients				
Yes	53.7	73.8	50.0	54.5
Depends on clinical factors/ timing	6.0	4.6	15.2	16.7
Active surveillance performed in ≥1 area of hospital	17.4	20.3	7.2	14.5

1604. Carbapenem Resistant Klebsiella pneumoniae: Epidemiology of the Regional Spread in Southern Indiana and Barriers for Prevention

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: The emergence of carbapenem resistance among Enterobacteriaceae (CRE) represent a serious threat to public health. The most common type of carbapenemase in the United States is the *Klebsiella pneumoniae* carbapenemase (KPC).

Methods: We conducted a retrospective study of cases of KPC identified in Evansville, Indiana, between September 2009, and March 2013. We identified all the KPC isolated at the two acute care hospitals microbiology laboratories, and reviewed the clinical data. Patients were admitted in two acute care hospitals (ACH), one long-term acute care hospital (LTAC), and one rehabilitation hospital (RH).

Results: Sixteen patients were identified with KPC in the studied period. Thirteen KPC patients were identified at the LTAC, one from each ACH, and one at a nursing home. Four patients had KPC isolated after their transfer from the LTAC, either to ACH or to the RH. There was a significant rate of transfer of patients among the facilities and half of the cases were admitted to the LTAC from ACH's other than the two local ACH. Eleven cases were identified during a 10 month interval while the other 5 cases were spread over 33 months of study.

Patients were older with multiple comorbid conditions. More than one third were on dialysis, and one third on ventilator. The KPC isolates were obtained from urine (6), respiratory secretions (6), blood (4), and wound (1). Many patients also had infections with other multidrug resistant organisms. Five patients (30%) died within 30 days of the KPC isolation and 60% within one year.

Several barriers for prevention of KPC spread were identified during the investigation. Every hospital in the region and every ID physician is independent. Infection Control supervision was done by a different ID physician at each of the four hospitals in the area. At the LTAC, which was central to the regional outbreak, the ID physicians work on a monthly rotation and that made identification of trends more difficult.

Conclusion: Although most of the cases were identified at the LTAC, all hospitals in the region were affected. Successful control of CRE will require a coordinated, regional effort among acute and long-term health care facilities. Laboratories will need to identify the multiple mechanisms by which organisms develop carbapenem resistance.

1605. Statewide Acute Care Survey on Practices Regarding Carbapenem-Resistant Enterobacteriaceae in Oregon

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Carbapenem-resistant *Enterobacteriaceae* (CRE) are rare in Oregon, and infection control practices and knowledge among infection preventionists (IPs) are unknown. A statewide survey of IPs was conducted to evaluate CRE infection control knowledge and practices.

Methods: In November 2012 we sent a 27-question self-administered survey to 62 infection control programs in acute care settings in Oregon. Questions focused on facility-specific definitions of multi-drug resistant organisms (MDROs), infection control practices and surveillance around MDROs.

Results: Forty-five (73%) IC programs responded; not all responded to every question and non-responses dropped from the denominator. Nine (28%) programs defined multi-drug resistant (MDR) *Enterobacteriaceae* as resistant to at least two and 8 (25%) as resistant to three classes of antimicrobials; 13 (41%) used alternate classifications. When defining antibiotic class, the majority of IPs (N= 23; 70%) do not consider cephalosporins and β-lactams to be in the same antimicrobial class; 7 (21%) were unsure and 3 (9%) considered them to be within the same class. Three (9%) respondents have encountered CRE in their facility. Eighty five percent of respondents would use contact precautions with CRE patients. No facility has conducted a CRE point prevalence study. Fifteen (45%) facilities report reviewing microbiology records to detect unrecognized CRE cases. Three facilities identified CRE in their facility as a result of retrospective review. Fifty-eight percent of IPs agreed that their facility is aware of patients' MDRO status upon admission. When asked to rank the top 3 MDRO priorities in their facility, IPs rarely selected CRE (15%), while 42% ranked ESBL as a top priority. Most facilities are aware of the CDC CRE toolkit (N=31; 94%). All respondents expressed interest in CRE education; most desired formats included printed material (100%), presentations (97%), and webinars (91%).

Conclusion: Definitions of MDR *Enterobacteriaceae* vary widely across facilities and IPs are uncertain whether MDRO status of patients is communicated at the time of transfer. Active surveillance for CRE is uncommon and CRE is not considered a high priority in most facilities. These findings suggest opportunities to improve CRE education in Oregon.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1606. Characteristics of Carbapenem-resistant Enterobacteriaceae-positive Patients in Oregon

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

Carbapenem-resistant *Enterobacteriaceae* (CRE) are an emerging public health problem. This review was performed to better understand statewide CRE epidemiology and characteristics of CRE-positive patients.

Methods:

Mandatory reporting of CRE in Oregon began in December 2011. We reviewed medical records of all patients with CRE-positive cultures reported to the Oregon Health Authority through March 2013. Patient demographics and risk factors for CRE were analyzed. Carbapenemase production was assessed via Modified Hodge Test (MHT) and PCR for *Klebsiella pneumoniae* carbapenemase (KPC) and New Delhi metallo-beta-lactamase (NDM).

Results:

CRE were reported in 49 patients; median age was 65 (IQR 48, 76) and the majority were female (n=32; 65%). Most patients (n=31; 63%) were hospitalized at the time cultures were obtained; other healthcare settings from which CRE were isolated included outpatient clinics (n=12; 25%), emergency departments or urgent care (n=4; 8%), and long-term care facilities (n=2; 4%). Culture site and results of carbapenemase testing arranged by species are summarized in the Table.

Organism	Number	Culture Site				Carbapenemase Testing	
		Urine	Blood	Respiratory	Wound	MHT+	KPC +

Enterobacter cloacae	26	20	3	1	2	16	0
Klebsiella pneumoniae	9	6	1	0	2	4	3
Enterobacter aerogenes	8	6	1	1	0	3	0
Escherichia coli	2	2	0	0	0	0	0
Citrobacter spp	1	1	0	0	0	1	0
Serratia marcescens	1	0	1	0	0	0	0
Proteus mirabilis	1	1	0	0	0	ND	0
Enterobacter spp	1	1	0	0	0	0	0
Total	49	37(76%)	6(12%)	2(4%)	4(8%)	24(49%)	3(6%)

PCR testing for NDM was negative in all isolates. The three patients harboring KPCs were not epidemiologically linked, and each had received recent healthcare outside Oregon.

Conclusion:

CRE reported in Oregon are predominantly *Enterobacter* spp. isolated from the urine of hospitalized patients or outpatients, and are not carbapenemase-producers. The paucity of reported carbapenemase-producing CRE indicates that these organisms are pre-emergent in Oregon. This presents a unique opportunity for a coordinated regional approach to rapidly detect and prevent the spread of CRE in a low-prevalence setting.

1607. Associated Mortality Among Carbapenem-resistant Klebsiella pneumoniae cases in Los Angeles County Using Electronic Death Registry Data - 2010-2012

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: CRKP is an emerging multidrug resistant pathogen and most frequently isolated species of carbapenem-resistant *Enterobacteriaceae*. In hospital specific studies, CRKP attributable mortality ranges from 44-50%. Two year laboratory-based surveillance of CRKP in Los Angeles County (LAC) gave insight to prevalence in the healthcare community; however mortality is unknown.

Methods: California Electronic Death Registry System (CA-EDRS) data for all deaths from June 2010-December 2012 was obtained from the California Department of Public Health. Data set included basic demographic information as well as location of death, 4 contributing causes of death (COD) and other significant conditions. Cases in CRKP surveillance data, defined as a KP isolate with resistance to all carbapenems by CLSI criteria, were matched to CA-EDRS by first, last name and date of birth. COD variables for matches were searched for key words indicating infectious COD (bacteremia, pneumonia, urinary tract infection, decubitus ulcers). Mortality odds ratios (MOR) were calculated on CRKP specimen type and correlating infectious COD.

Results: Review yielded 862 matches among 1774 individuals in CRKP data set, resulting in 48.6% mortality among cases. Mean age was 75 years (range 22-101 years). The median length of time from diagnosis to death was 32 days (range 0-665 days). Half of deaths occurred in SNF residents. Cases with urine positive CRKP comprised a larger proportion of deaths (307, 36.2%). 468 cases (54%) had at least one infectious COD, the most frequently identified as pneumonia (304, 35%) and bacteremia (282, 33%). Deaths in cases with positive wounds had higher odds of decubitus ulcers as a COD (MOR 5.6, 95% CI [2.5-13.8]), as well as sputum positive cases and pneumonia as COD (MOR 1.64, 95% CI [1.22-2.2]). CRKP was specifically identified as COD in four cases.

Conclusion: Infectious COD were identified nearly half of CRKP cases; there was an increased odds of decubitus ulcers as a contributing COD among wound positive cases than non-wound positive cases. If validated, review of electronic death record data may provide an estimate of mortality among CRKP positive individuals in the LAC healthcare community similar to that reported in the literature.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1608. Risk Factors and Mortality in Carbapenem Resistant Gram Negative Bacteremias: A Retrospective Analysis from a Tertiary Health Care Setting in India

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Infections with multi drug resistant gram negative bacteria are a major concern in tertiary care hospitals in India. Blood stream infections with such organisms lead to increased duration of hospitalization, morbidity and mortality. The lack of new antibiotics for gram negative infections portends a bleak future.

Methods: A retrospective analysis of adults >18 years with first episode of bacteremia due to carbapenem resistant gram negative bacteria, from Jan 2011 to March 2013 was performed, to evaluate risk factors and mortality. The primary outcome was mortality.

Results: 55 cases of blood stream infections with carbapenem resistant gram negative bacteria were recognized. Total positive blood cultures for the same time period were 741. Carbapenem resistant Klebsiella pneumoniae was isolated in 24/55(43.63%) patients, followed by MDR Acinetobacter baumanii in 18/55(32.72%), Pseudomonas aeruginosa in 6/55 (10.9%), Escherichia coli 4/55 (7.27%) and MDR Enterobacter in 3/55 (5.45%).

Mortality was 50.9% (28/55). The common risk factors were chronic hemodialysis, chronic liver disease, malignancy and multiple hospitalizations. Most of the carbapenem resistant bacteria were sensitive to colistin, although MIC determination was not done. Most of the blood stream infections due to multidrug resistant gram negative bacteria occurred beyond the first week of hospitalization.

Conclusion: Conclusions: 1. Mortality due to carbapenamase producing bacteria is high.
2. Resistance to colistin was not observed.
3. Klebsiella pneumoniae appears to be the most common carbapenamase producing organism in our setting.

References:
1. Predictors of Mortality in Bloodstream Infections Caused by Carbapenemase-Producing K. pneumonia: Importance of Combination Therapy. Clinical Infectious Diseases 2012;55(7):943-50

1609. The natural history of colonization with carbapenem-resistant Enterobacteriaceae: outcomes related to colonization

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

Carbapenem-resistant Enterobacteriaceae (CRE) are becoming increasingly prevalent in U.S. healthcare facilities. Few reports detail the natural history of CRE colonization. We describe clinical outcomes of CRE infection and colonization, including serial surveillance cultures, in a cohort of CRE-colonized patients at the NIH Clinical Center, a 240-bed research hospital.

Methods:

Patients found to be colonized with CRE were followed closely and screened with surveillance cultures during return visits to monitor colonization status. Surveillance cultures collected from throat, groin, perirectal area, and stool were inoculated on KPC CHROMagar (Hardy Diagnostics). Suspicious colonies were identified by MALDI-TOF mass spectrometry and tested by KPC PCR and modified Hodge test. Clinical records were reviewed retrospectively to provide insight into the natural history of KPC colonization.

Results:

Among 22 patients identified with CRE colonization, 19 carried a single nosocomial strain of *K. pneumoniae,* 3 patients carried distinct strains of *Klebsiella*. Nine highly immunocompromised patients developed bacteremia with KPC-carrying *Klebsiella* a median of 11 days (range 2-37) after colonization was first detected. Seven patients died of bacteremia and two patients survived bacteremia but died of underlying illness. Among colonized patients who did not become infected, 6 died of underlying conditions and 1 has not yet returned for followup. We have collected surveillance cultures collected from 6 of the surviving colonized patients. One patient remains colonized after 507 days. Five patients' cultures have reverted to negative after a mean of 5.2 sets of surveillance cultures over a median of 216 days (range 134-376).

Conclusion:

CRE infections have a very high mortality rate among immunocompromised patients. All patients who had CRE bacteremia died, and no surviving patients have had CRE isolated from any clinical culture. CRE colonization portends a poor prognosis, particularly among immunocompromised patients. Patients who do not develop infection can have prolonged CRE colonization that may clear over time.

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1610. Risk for Readmissions in Hospitalized Patients with Carbapenem-Resistant Klebsiella pneumoniae

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

Carbapenem-resistant *Klebsiella pneumoniae* (CRKP) poses an increasing threat to hospitalized patients.

Methods:

The CRKP consortium prospectively studies CRKP in hospitalized patients in 18 medical centers (3 health care systems) in the Great Lakes region. Here, we have focused on readmissions during which CRKP was again isolated. Factors

independently associated with readmission were examined with a multivariable logistic regression model.

Results:

In a 14 month study period, 250 unique patients were included. Thirty-nine (16%) patients who did not survive their first admission were excluded. Of the remaining 211, 60 (28%) patients had a readmission with another CRKP positive culture, of whom 18 (30%) had more than one readmission. Thirteen (22%) patients had readmission at a different hospital, but only 2 (3%) were readmitted to a hospital belonging to a different health care system. Thirty five patients (58%) had CRKP isolated from the same source (usually urine, n=29) during all readmissions. The characteristics of all first admissions are listed in the table. The variables associated with risk for CRKP readmissions were home origin and Charlson comorbidity index.

Conclusion:

Over 1 in 4 hospitalized patients with cultures positive for CRKP are readmitted with recurrent CRKP positive cultures. This illustrates the chronic nature of CRKP colonization, the contribution to CRKP colonization pressure, clinical morbidity and risk for continued transmission. Home origin and comorbid illness were associated with higher risk of CRKP readmission.

Variable	No Readmit	Readmit	OR (95% CI)	p*
n	151	60		
Age (median, IQR)	71 (59-81)	70 (55-82)		
Charlson comorbidity index (median, IQR)	3 (2-5)	4 (2-7)	1.2 (1.1-1.4)*	0.002
Length of stay, days (median, IQR)	9 (5-14)	8 (6-18)		
ICU stay	65 (43)	25 (42)		
CRKP infection	78 (52)	34 (57)		
Pitt≥4	45 (30)	19 (32)		
Home origin	37 (24)	23 (38)	2.4 (1.2-4.7)	0.012
Home disposition	30 (20)	13 (22)		

Table. Characteristics of first admission, comparing those patients who were subsequently readmitted with CRKP vs. all others. All data in n(%), unless otherwise stated. *per unit increase.

1611. Hospital Surveillance for Carbapenemase-Producing Organisms in the Wake of an Outbreak

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: From 6/2011 through 12/2011, a cluster of carbapenem-resistant *Klebsiella* infections and colonization occurred in the NIH Clinical Center. Following the cluster, the hospital continued monitoring its highly immunocompromised patient population for carbapenem-resistant *Enterobacteriaceae* (CRE) using active surveillance and periodic environmental sampling.

Methods: From 1/1/2012 through 3/2013, rectal, groin, and throat swabs were collected on admission and twice weekly in the ICU and another high-risk unit. Rectal swabs were collected from patients who were transferred from other institutions or transferred out of the ICU, and monthly on medical-surgical inpatients. Most swabs were plated on KPC Chromagar (Hardy Diagnostics) and incubated at 35C for 18-24 hours; some were tested directly by KPC PCR. Numerous environmental surfaces were cultured. Suspicious colonies were identified by MALDI-TOF mass spectrometry and analyzed using modified Hodge test and KPC PCR. To compare KPC-carrying strains, we performed Rep-PCR, pulsed field gel electrophoresis, and whole-genome sequencing. All CRE-colonized patients were isolated and cohorted in a single area with dedicated nursing and 24-hour adherence monitoring. Equipment and rooms were disinfected with bleach, hydrogen peroxide vapor, and/or ultraviolet light.

Results: We collected 10,989 surveillance swabs from 1,705 patients, representing compliance with only 2/3 of surveillance swab orders; 98.25% of swabs were cultured and 1.75% were tested directly by KPC PCR. Among 4 newly identified CRE patients, 1 acquired the cluster strain and 3 had unrelated isolates, likely acquired at other facilities. Among 271 environmental samples, 12 (4.4%) grew CRE (9 sink drains, 1 faucet aerator, 1 handrail, and 1 medication room surfaces). All but one environmental isolate was linked to a colonized patient.

Conclusion: Stringent infection control measures and close monitoring of patients and the hospital environment have likely helped limit CRE transmission. We are improving patient compliance with active surveillance culturing through staff and patient education. Contaminated sinks are a potential reservoir and, once documented, should be addressed on an ongoing basis.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1612. Outcomes of an Enhanced Surveillance Program for Carbapenem-resistant Enterobacteriaceae (CRE)

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background:

Both acute and long-term acute care hospitals (LTACH) have seen an alarming increase in the prevalence of CRE. We studied two strategies to control the spread of CRE: 1.) screening patients with epidemiologic links to unrecognized CRE colonized or infected patients (ring surveillance, RS), and 2.) improving CRE culture detection (culture validation, CV).

Methods:

Hospitalized patients with CRE cultures between Sep 2011 and Jan 2013 were included. In the RS study, new CRE patients not on contact precautions triggered rectal surveillance of all patients on the same ward. In the CV study, two rectal swabs were obtained from patients already on contact precautions with CRE cultures. Swab #1 was plated directly on vancomycin, amphotericin B, ceftazidime, and clindamycin (VACC) plates with ertapenem resistance confirmed by Kirby-Bauer. Swab #2 was inoculated in ertapenem-enriched media (EEM) prior to plating. Polymerase chain reaction for the *Klebsiella pneumoniae* carbapenemase gene and pulsed-field gel electrophoresis (PFGE) were performed as indicated. Patient charts were reviewed and clinical characteristics and outcomes recorded.

Results:

RS occurred 14 times, included 173 patients and identified two patients with CRE colonization. These patient's strains were unrelated to the index patient by PFGE. See Table for clinical details. One patient who was negative during RS subsequently had a positive culture for CRE that was closely related by PFGE to the index strain. In addition, seven other new CRE positive patients shared time on wards with CRE positive patients outside of the timeframe of RS. PFGE typing confirmed two possible transmissions in this group. In the CV study, the sensitivity of direct plating on VACC plates compared with inoculation in EEM was 91% vs. 100%. Both methods had 100% specificity.

	RS study (n=14)	CV study (n=25)
Mean age, yr	59	55
Female (%)	71	56
Recent hospital, LTACH, or nursing facility exposure (%)	86	96
Prior antibiotic use during hospital stay(%)	43	64
Mean Charlson score	3	3
Hosp mortality (%)	29	16

Conclusion:

RS identified patients with unrecognized CRE colonization, but failed to comprehensively capture CRE transmissions. Further refinement of RS strategy is recommended. Inoculation of rectal swabs in EEM prior to plating increases the sensitivity of detecting CRE.

1613. Multidrug-Resistant Enterobacteriaceae: Prevalence of Gastrointestinal Colonization and Short-Term Secondary Transmission in a Tertiary-Care Hospital

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: The steadily increasing occurrence of multidrug-resistant *Enterobacteriaceae* (MDRE) is concerning, especially in hospitalized patients. This study aims to determine the prevalence of gastrointestinal colonization of MDRE with plasmid-mediated β-lactamases in our hospital and to evaluate their short-term transmission.

Methods: From December 10th to 13th 2012, all patients admitted to our hospital were screened by rectal swabbing. ChromID ESBL and ChromID CARBA agar (bioMérieux, Marcy-L'Étoile, France) were used to identify multidrug-resistant isolates. Further identification and susceptibility testing were performed by Vitek 2 (bioMérieux). Confirmation of resistance mechanisms by polymerase chain reaction (PCR) was performed by the Quebec Laboratory of Public Health. No supplementary infection control precautions were initiated for patients having a positive MDRE screening. Also, patients in the same room as carriers were identified and screened at discharge from hospital or up to a month after initial screening. Clinical and demographic data were collected through chart reviewing.

Results: Of 449 patients screened, 7.6% (n = 34) were colonized with a MDRE. Resistance mechanisms confirmed by PCR were as follows: 64.7% (n=22) had an extended spectrum β-lactamase (ESBL), 20.6% (n=7) a plasmid-mediated AmpC cephalosporinase (AmpC), 5.9% (n=2) an oxacillinase (OXA-1) and 8.8% (n=3) a combination of resistance mechanisms (ESBL with AmpC or ESBL with OXA-1). The most frequent genes were the CTX-M for the ESBL group and CIT for the plasmid-mediated AmpC group. No carbapenemase-producing bacteria were found in our cohort. A total of 39 contact patients were identified and of these, 24 were screened. No transmission from colonized patients to room contacts was documented, but four contacts nosocomially acquired a MDRE strain within less than a month of hospitalization.

Conclusion: Nearly one out of ten patients was colonized with MDRE in our center. Nevertheless, no short-term

transmission by room contact with MDRE gastrointestinal carriers was observed in our study. This supports the hypothesis that the screening and isolation of carriers are not required routinely.

1614. How fast do patients acquire Klebsiella pneumoniae (Kp) containing blaKPC (Kp KPC)? An Analysis of Epidemiology of Kp KPC at a Long-Term Acute Care Facility

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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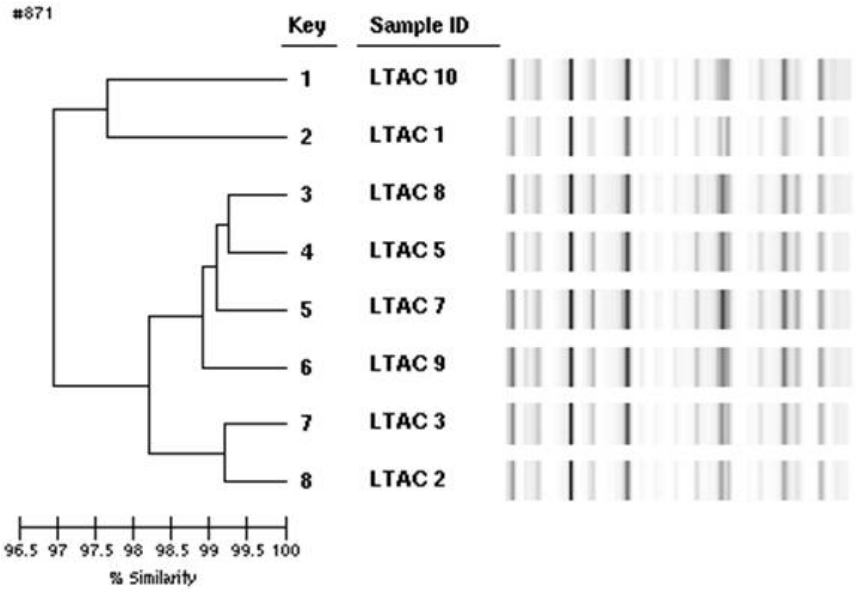
Background: Infections due to *Kp* KPC are an emerging threat to long-term acute care hospitals (LTACs), which typically admit chronically and critically ill patients. Data regarding the rapidity of acquisition of *Kp* KPC are not yet available. This knowledge has implications for the development of containment and screening strategies in LTACs. **Methods:** A retrospective chart review of 30 patients with *Kp* KPC isolates obtained from Dec. 2010 through Aug. 2012 was conducted in a 77-bed LTAC in Detroit, MI, to analyze the timing of acquisition, incidence pattern, possible modes of transmission, and 30-day and 1-year overall mortality rates among patients. PCR gene amplification, repetitive-sequence-based PCR (rep-PCR) and multilocus sequence typing (MLST) was performed to determine the clonal relationships between eight of the CRE isolates. **Results:** Of the 30 patients identified, 24 (80%) were infected and 6 (20%) were colonized with *Kp* KPC. The mean age of patients was 70 ±11.5 years, 19 (63%) were females, and 25 (83%) were African-Americans. 24 (80%) patients acquired *Kp* KPC more than 48 hours after admission. Among those infected, 20 (83%) had bloodstream infections and 4 (17%) had urinary tract infections. Among the 6 colonized patients, sites included urine 3 (50%), sputum 2 (33%) and genital discharge 1 (17%). The 30-day all-cause mortality rate was 17% (n=5), and the 1-year all-cause mortality rate was 30% (n=9). Eight representative strains were further studied. Molecular genotyping using rep-PCR demonstrated a similarity index of > 95% between the eight strains of *Kp* KPC, indicating they were clonally related (Fig 1). Furthermore, comparison to the reference strain 300/1240 suggested that all eight isolates belonged to the MLST sequence ST258 and contained the bla_{KPC-3} sequence. **Conclusion:** As 80% of residents acquired *Kp* KPC after 48 h of admission to an LTAC, isolation and containment strategies using conventional microbiological methods may be adequate to prevent new acquisition of *Kp* KPC in LTACs. This time to acquisition is consistent with either environmental or person to person spread.

Figure 1. Dendrogram and similarity matrix for *K. pneumonia* for eight isolates.



Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1615. The effectiveness of routine daily chlorhexidine (CHG) bathing in reducing Klebsiella pneumoniae carbapenemase-producing Enterobacteriaceae (KPC) skin burden among long-term acute care hospital (LTACH) patients

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Whether daily CHG bathing reduces KPC skin colonization of LTACH patients is unclear. During a 4-LTACH control intervention that included daily CHG bathing by nursing staff, we assessed the effect on KPC skin burden.

Methods: Randomly selected LTACH patients with KPC rectal colonization were assessed at 5 body sites (groin, back, antecubital, axilla, neck) immediately pre and post routine daily CHG baths (2% CHG cloths, Sage). 10x10 cm areas of skin were sampled using 2 dry flocked nylon swabs. 1 swab was cultured by a MacConkey agar-ertapenem disk method and the 2nd by a meropenem enrichment broth method. Unique, screen-positive colonies were tested for bla_{KPC} by PCR. CHG concentration at each site was measured using a 3rd swab and a semiquantitative colorimetric assay. CHG MICs were determined by agar dilution. Statistical testing was performed using Chi square, non-parametric tests, or Cochran-Mantel-Haenszel statistics.

Results: We assessed 51 patients; the percent with at least 1 KPC positive skin site was higher among pre bath (61%) vs post bath patients (29%). Pre bath KPC colonization rates differed across skin sites (P<0.001) with 45% of axillary and 37% of groin sites KPC positive (Table). Post bath KPC colonization rates were lower (9%) and did not differ by site (P=0.16).

Median concentration of CHG on skin was higher among post vs pre bath patients (median, 312 vs 78 ug/mL, P<0.001) but differed across body sites (P<0.001); groin and axillary sites had highest median CHG values.

The percent of skin sites with CHG concentrations above the KPC CHG MIC_{90} (128 ug/mL) was higher among post vs pre bath patients (75% vs 40%, P<0.001). For any skin site, a CHG concentration above the KPC MIC_{90} conferred a relative risk of 0.51 (95% CI, 0.34 to 0.77; P=0.002) for KPC skin colonization.

Table. KPC culture positivity and chlorhexidine (CHG) concentrations, by skin site

		Groin	Back	Antecubital	Axilla	Neck	*P*
KPC positive, %	Pre-bath	37	6	19	45	6	<0.001
	Post-bath	10	2	6	14	14	0.16
CHG concentration, median µg/mL	Pre-bath	312.5	39.1	39.1	156.3	19.5	<0.001
	Post-bath	1250.0	312.5	312.5	625.0	78.1	<0.001
CHG concentration > MIC_{90}, %	Pre-bath	82	25	25	57	8	<0.001
	Post-bath	98	69	76	82	47	<0.001

Note. P value tests null hypothesis that all body sites have same proportion or value

Conclusion: CHG protected against KPC skin colonization, particularly if a skin concentration greater than the KPC CHG MIC_{90} was achieved. However, among LTACH patients rectally colonized with KPC and receiving routine daily CHG bathing, KPC skin colonization was still often detected, particularly at axillary and groin sites, and more often before the daily bath when skin CHG concentrations were lowest. Whether KPC are resident colonizers of LTACH patients' skin warrants study.

1616. Carbapenem-Resistant Klebsiella pneumoniae Cluster in a Long-term Skilled Nursing Facility Highlights the Role of Local Public Health in Prevention and Control

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: The Philadelphia Department of Public Health (PDPH) was informed by a Hospital Infection Preventionist (IP) on October 16, 2012 of a cluster of four patients with Carbapenem-resistant *Klebsiella pneumoniae* (CRKP) at a 180-bed long-term skilled nursing facility (SNF). We sought to characterize the outbreak, implement infection control measures, and identify educational needs for CRKP prevention in SNFs.

Methods: A case was defined as a CRKP isolate collected from a patient in the SNF or within 48 hours of hospitalization. Observational surveys and two point prevalence surveys were conducted to assess infection control compliance and identify colonized patients. Resistance mechanism and PFGE testing on isolates were performed. A survey was administered to assess knowledge prior to in-servicing all building staff.

Results: Eight cases were detected from 10/16/2012 – 1/15/2013 throughout the facility. Median age of case-patients was 74.5 years (range: 65-91 years); all had underlying conditions. Infections included urinary tract infection (UTI) (n=3), UTI and septicemia (n=2), and pneumonia (n=2); point prevalence surveys detected one colonized case. The four submitted outbreak isolates were *Klebsiella pneumoniae* carbapenemase producers and had identical pulsed-field gel electrophoresis patterns. During the initial site visit, patients with positive CRKP infections were not on contact precautions and staff did not have knowledge of CRE or how it was transmitted. Deficiencies in hand hygiene and contact precautions were detected during the observational survey. Surveys completed by staff (n=80) showed a deficit in knowledge about transmission-based precautions, particularly among nursing assistants compared to nurses (p=0.01).

Conclusion: This outbreak in a SNF was most likely sustained due to lack of knowledge about CRE and problems implementing and adhering to MDRO interventions, highlighting the need for CRE education and challenges with contact precaution use in the long-term setting. Expanding the local health department role, PDPH plans to take a community perspective for prevention and control that includes characterizing burden, enhancing communication between facilities, and educating SNFs in an area where CRE is known to be prevalent.

1617. Targeted Infection Prevention (TIP) Study: Epidemiology of antibiotic resistant gram-negative bacilli colonization in nursing home residents with indwelling devices

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background : We characterize the clinical and epidemiologic characteristics of antibiotic resistant gram-negative bacilli (R-GNB) and the extent to which it has emerged in community based nursing homes (NH).

Methods **:** As a part of a cluster-randomized study, we evaluated the prevalence of ciprofloxacin-resistant (CIP-R GNB) and ceftazidime-resistant gram-negative bacilli (CTZ-R GNB) among 418 residents with urinary catheters or feeding tubes in 12 NHs over 3 years of enrollment. Cultures (from nares, oropharynx, groin, perianal area, and wounds, feeding tube site and suprapubic catheter site, if present) and clinical data were obtained at enrollment, after 15 days, and every 30 days thereafter.

Results : A total of 6525 anatomic sites were cultured, 1422 (21.8%) swabs were positive for 2227 R-GNB, 1396 (21.4%) swabs positive for 1730 CIP-R GNB, and 447 (6.9%) swabs positive for 497 CTZ-R GNB. The most common site of R-GNB colonization was groin (559, 34%), followed by perianal area (438, 53.5%), suprapubic catheter (145, 43.9%), oropharynx (100, 7.9%), feeding tube (81, 10.6%), wounds (n=53, 58.2%) and nares (46, 2.9%). 408 sites were co-colonized with CIP-R GNB and CTZ-R GNB with groin and perianal being the most common sites of co-colonization. The most common species of R-GNB were *Proteus mirabilis* (28.4%), *Escherichia coli* (25.1%), *Klebsiella pneumoniae* (11.8%), *Acinetobacter baumanii* (8.5%), *and Pseudomonas aeruginosa* (6.2%). Resistant *P. mirabilis*, *K. pneumonia* and *P. aeruginosa* most commonly colonized the groin, while resistant *E. coli* was most commonly found in the perianal area. Anatomic site colonization and colonizing organism distribution was similar for both CIP-R GNB and CTZ-R GNB.

Conclusion : Multi-site R-GNB colonization is common in nursing home residents with indwelling devices. Our data show that R-GNB colonization is dynamic, and has implications for designing of infection prevention strategies in this frail and functionally impaired population.

1618. Proactive infection control measures to prevent nosocomial transmission of carbapenem-resistant Enterobacteriaceae in a non-endemic area

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background: Identification of hospitalized carbapenem-resistant *Enterobacteriaceae* (CRE)-positive patient is important in preventing nosocomial transmission. The objective of this study is to illustrate the implementation of proactive infection control measures in preventing nosocomial transmission of CRE in a healthcare region of over 3200 beds in Hong Kong between 1 October 2010 and 31 December 2011.

Methods: The program included active surveillance culture in patients with history of medical tourism and surgical operation outside Hong Kong within 12 months before admission, and "added test" as an opportunistic CRE screening in all fecal specimens submitted to the laboratory. Outbreak investigation and contact tracing were conducted for CRE-positive patients. Serial quantitative culture was performed on CRE-positive patients and the duration of fecal carriage of CRE was analyzed.

Results: During the study period, a total of 6533 patients were screened for CRE, of which 76 patients were positive (10 from active surveillance culture, 65 from “added test”, and 1 secondary case from contact tracing of 233 patients with no nosocomial outbreak), resulting in an overall rate of CRE fecal carriage of 1.2%. The median time of fecal carriage of CRE was 43 days (range, 13-119 days). Beta-lactam-beta-lactamase-inhibitors, cephalosporins, and fluoroquinolones were associated significantly with high fecal bacterial load when used 90 days before CRE detection, while use of cephalosporins, carbapenems, and fluoroquinolones after CRE detection are significantly associated with longer duration of carriage. The duration of fecal carriage of CRE also correlates significantly with the initial fecal bacterial load (Pearson correlation, 0.53; p value, 0.02).

Conclusion: Proactive infection control measures by enhanced surveillance program identify CRE-positive patients and data obtained are useful for the planning of and resource allocation for CRE control.

1619. Carbapenem-resistant Enterobacteriaceae (CRE) Klebsiella pneumonia (KP) Cluster Analysis

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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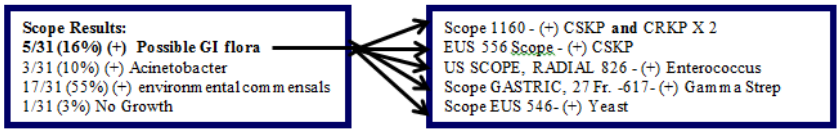
Background: CRE Infections are a challenge in health-care. CRKP is the species most commonly encountered in the US and resistant to most antimicrobials. Infections have been associated with high rates of morbidity and mortality. The University of Pittsburgh Medical Center, Presbyterian (UPMC-P) is a 766-bed tertiary care facility and one of the largest solid organ transplantation programs in the US, performing >300 kidney, liver, intestinal and multi-visceral transplants per year. In 2012, CRKP incidence increased from 0.24 to 0.33; many patients had an Endoscopic Retrograde Cholangiopancreatography (ERCP) prior to (+) culture. Our objective is to investigate the CRKP increase.

Methods: 2011 – 2012 CRKP incidence and Hospital Acquired infections (HAI) were reviewed. Targeted active surveillance testing (AST) was performed using HardyCHROM™ Carbapenemase media. 68 patients located on 4 GI/transplant floors

were rectally screened. Scope and washer manufacturers were notified and evaluated the cleaning/high level disinfection (C/HLD) process. GI lab/scopes were inspected, 31 scopes were cultured using previously described protocol. Usage document was obtained on implicated scope. Pulsed Field Gel Electrophoresis (PFGE) was done using XbaI as previously described. **Results:** CRKP HAI rates were not increased; however, many cases were present on admission in patients who had a recent GI procedure. AST – did not identify any additional colonized patients. C/HLD processes were reviewed with no issues. 5/31 (16%) scopes grew organisms consistent with GI flora.1/5 grew both Carbapenem sensitive (CS) KP and CRKP.



PFGE Summary

TYPE			
1	*2*	*3*	*4*
CSKP	*CSKP*	*CRKP*	*CRKP*
1/23 (4%) same PFGE Type as Scope 1160 AND EUS 556	1/23 (4%) same PFGE Type as Scope 1160	•18/23 (78%) same PFGE Type as Scope 1160 o 9/18 (50%) NOT scoped with 1160 ▪ 6/9 (67%) ERCP; not ERCP 1160 ▪ 1/9 (11%) Colonoscopy ▪ 1/9 (11%) UGI ▪ 1/9 (11%) No procedure o 9/18 (50%) scoped with 1160 • 7/9 (78%) identified as KPC POST ERCP 1160 • 2/9 (22%) identified PRE ERCP 1160	
Post ERCP with 1092	Post ERCP with 1160		• Scoped with 1160 - identified post ERCP

Conclusion:

- Scope related outbreaks due to HLD failure have been frequently reported.
- 2 CSKP clusters (types 1 and 2) and 1 CRKP cluster matched scope isolates.
- AST did not identify any additional colonized, supporting lack of transmission on the patient care areas.
- CRKP colonization/infection increase in GI Patients may have been associated with Scope 1160.

µ Majority of patients clustered with scope 1160

- Of the 9/18 PFGE 3 cases were scoped with 1160
- Of these 7/9 (78%) were identified post ERCP 1160
- A case control study is underway to better understand association.

1620. Molecular epidemiology and antibiotic susceptibility of IMP-type metallo-?-lactamase-producing Enterobacter cloacae isolated in a tertiary medical center in Japan

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

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Background : Reports of carbapenemase-producing *E. cloacae* have been increasing worldwide. However, information on the molecular epidemiology of IMP-type metallo-beta-lactamase (MBL)-producing *E. cloacae* (IMP-EC) is limited.

Methods : During the study period (10/2011 – 12/2012), clinical isolates of *E. cloacae* from National Center for Global Health and Medicine (NCGM) that were resistant to one or multiple agents in the extended-spectrum cephalosporin class and/or that demonstrated elevated MICs to imipenem and/or meropenem were tested for IMP-MBL production by immunochromatographic assay (ICGA). Isolates positive for MBL by ICGA were then analyzed by PCR, DNA sequencing and multilocus sequence typing. MICs were determined according to CLSI criteria (M100-S22).

Results : Of 18 *E. cloacae* positive for MBL by ICGA, 17 isolates from 15 patients were confirmed to be positive for bla_{IMP}. Fourteen (82.4%) and 13 (76.5%) IMP-EC were found to be sensitive (MIC ≤1 µg/mL) to imipenem and meropenem, respectively, and 8 (47.1%) and 7 (41.2%) were sensitive to ciprofloxacin and aztreonam. All 17 isolates were sensitive to gentamicin, amikacin, and colistin (EUCAST criteria v3.1). IMP-EC isolates were frequently positive for other resistant determinants (Table). The phylogenetic tree (Figure) revealed close relatedness among IMP-EC samples isolated from NCGM during the study period, except for one (No. 15) isolated from a patient who had been transferred from another hospital.

Conclusion : Our data suggest the possible nosocomial spread of IMP-EC. It is difficult to identify IMP-EC based solely on susceptibility results. Further studies are warranted to identify the clinical significance of IMP-EC, appropriate treatment, and control measures.

Table. Resistance genes among IMP- *E. cloacae*

No.	IMP-type (bla_{IMP})	aac(6')	aac/aad	gyrA	qnrS	bla_{TEM}
1[a]						

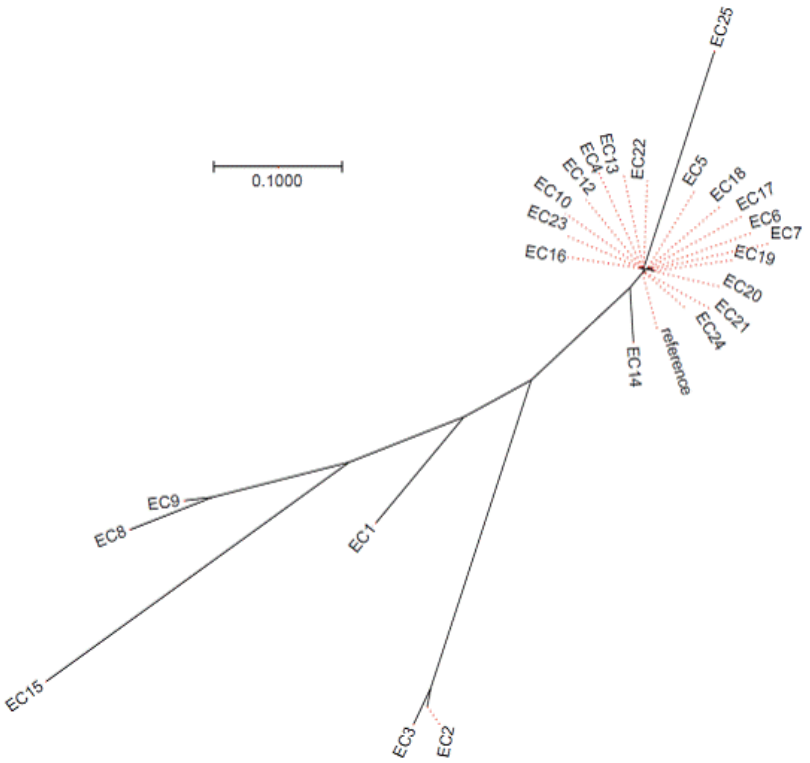
Figure. Phylogenetic tree of IMP- *E. cloacae*

2[a]						
3[b]						
4	1	IIc				
5	11		aacA1	S83I	+	
6				S83I		
7	11		aacA1	S83I	+	+
8[c]	1	IIc		S83Y		
9[c]	1	IIc	aadA1	S83Y		
10	1	IIc				
12	1	IIc				
13	1	IIc				
14	11	Ib	aacA4			+
15	1	IIc				
16	1	IIc				
17	1	IIc		S83Y		
18	11		aacA1	S83Y	+	
19	11		aacA1	S83Y	+	+
20	11		aacA1	S83Y		+
21	1	IIc				
22	1	IIc				
23	1	IIc				
24	1	IIc				
25[c]	1	IIc				

[a]Drug-susceptible, non-IMP-EC.

[b]Positive for IMP by ICGA, isolated in 2007 from NCGM.

[c]IMP-EC from other facilities in Japan.



1621. Emergence of VIM-producing Aeromonas caviae in Israeli hospitals

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

AMOS ADLER[1], MARC V. ASSOUS[2], SVETLANA PAIKIN[3], ANASTASIA SHULMAN[1], SARAH HILLEL[2], RIMA ARONOV[3], YEHUDA CARMELI[1] and **MITCHELL J. SCHWABER**[1]; [1]National Center for Infection Control, Tel Aviv, Israel, [2]Shaare Zedek Medical Center, Jerusalem, Israel, [3]Laniado Hospital, Netanya, Israel

Background:

Aeromonas species are globally distributed in the aquatic environment. Resistance to carbapenems is rare and mediated mostly by the chromosomal *cphA* gene. Our aims were to describe the molecular characteristics of the first cases of VIM-producing *Aeromonas caviae*isolated from human samples from two hospitals.

Methods:

Carbapenem-resistant *Aeromonas* (CRA) spp. were isolated from rectal surveillance cultures using CHROMagar™ KPC media. Bacterial identification was done by dnaJ sequencing. Antimicrobial susceptibility testing was done by agar dilution and via the VITEK-2 system. Detection of metallo-β-lactamase and other β-lactamase genes was done by PCR. Molecular typing was done by PFGE. The location of the bla_{VIM} gene was determined by plasmid transformation into the *E. coli* DH10B strain, S1-nuclease analysis and Southern blot. The genetic environment of the bla_{VIM}gene was determined by sequencing.

Results:

Four CRA isolates were identified in hospital 1 and one in hospital 2 in 2012-2013, all from surveillance cultures. Carbapenem MIC ranges were 0.5-8 µg/ml for ertapenem and imipenem and 0.25-8 µg/ml for meropenem. All isolates were resistant to gentamicin and susceptible to amikacin and ciprofloxacin. All isolates were positive by the modified Hodge test and showed synergy between ertapenem and EDTA. All isolates were *Aeromonas caviae*, comprising 4 different PFGE types. The carbapenemase genes were bla_{VIM-1} and bla_{VIM-35}; other carbapenemase genes, including *cphA*, were not identified. The bla_{VIM}gene was located on a class 1 integron. It was detected by Southern blot on a ~25-kb plasmid in all isolates, although transformation was successful in only one. This plasmid was non-typeable by replicon typing.

Conclusion:

This study is the first report of a plasmid-borne bla_{VIM} gene in *Aeromonas* isolated from human samples and the first report of VIM-producing gram-negative bacteria in Israel. These findings are alarming as this species may spread via water or sewage systems within the hospital or out to the community. Although clinical infection due to *Aeromonas* spp. is rare, the presence of the gene on mobile elements is of concern due to the potential for dissemination to other clinically important gram-negative pathogens.

1622. Impact of intensive infection control team activities on the acquisition of methicillin-resistant Staphylococcus aureus, drug-resistant Pseudomonas aeruginosa and the incidence of Clostridium difficile-associated disease

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

HIROMICHI SUZUKI, MD[1], JUNKO SENDA[1], YASUHARU TOKUDA, MD, MPH[2], KEITA YAMASHITA[1], NORIKO KOTAKI[1], HIROKO ISHIHARA[1] and HIROICHI ISHIKAWA, MD, PHD[1]; [1]Tsukuba Medical Center Hospital, Tsukuba, Japan, [2]Mito Kyodo General Hospital, University of Tsukuba, Mito, Japan

Background: The transmission of multidrug-resistant organisms (MDROs) is an emerging problem in acute healthcare facilities. To reduce this transmission, we have introduced intensive infection control team (ICT) activities and investigated the impact of their introduction.

Methods: This study was conducted at a single teaching hospital from April 1, 2010, to March 31, 2012. During the intervention period, all carbapenem use was monitored by the ICT and doctors using carbapenems inappropriately were individually instructed. Information related to patients with newly identified MDROs was provided daily to the ICT and instructions on the appropriate infection control measures for MDROs were given immediately with continuous monitoring. Medical records of newly hospitalized patients were reviewed daily to check previous microbiological results and infection control intervention by the ICT was also performed for patients with a previous history of MDROs.

Results: Compared with the pre-intervention period, the antimicrobial usage density of carbapenems decreased significantly (28.5 vs. 17.8 defined daily doses/1000 inpatient-days; p<0.001) and the frequency of use of sanitary items, especially the use of aprons, increased significantly (710 vs. 1854 pieces/1000 inpatient-days; p<0.001). The number of cases with hospital-acquired MRSA (0.66 vs. 0.29 cases/1000 inpatient-days; p<0.001), hospital-acquired drug-resistant *Pseudomonas aeruginosa* (0.23 vs. 0.06 cases/1000 inpatient-days; p=0.006) and nosocomial *Clostridium difficile*-associated disease (0.47 vs. 0.11 cases/1000 inpatient-days; p<0.001) decreased significantly during the intervention period.

Conclusion: Our study showed that proactive and continuous ICT interventions were effective for reduction of MDRO transmission.

1623. Utility of surveillance cultures for carbapenem-resistant Enterobacteriaceae, carbapenem-resistant Pseudomonas aeruginosa and vancomycin-resistant enterococci in bone marrow transplantation unit

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

LíSIA G M M TOMICH, MD[1], LAURO PERDIGãO NETO[1], MARJORIE VIEIRA[1], JESSICA RAMOS, MD[1], LUCAS CHAVES, MD[1], THAIS GUIMARãES, MD, PHD[2], ANNA SARA LEVIN, MD, PHD[3] and SILVIA COSTA, MD, PHD[1]; [1]Hospital Das Clínicas-FMUSP, São Paulo, Brazil, [2]Instituto Central - Hospital Das Clínicas, São Paulo, Brazil, [3]University of São Paulo, São Paulo, Brazil

Background: Surveillance strategies to detect colonization have been considered important tools for preventing and controlling the spread of microorganisms in the hospital setting. The objective was to evaluate the use of routine surveillance culture to screening colonization and infection by carbapenem-resistant Enterobacteriaceae (CRE), carbapenem-resistant *Pseudomonas aeruginosa* (CRPa) and vancomycin-resistant enterococci (VRE) in bone marrow transplantation (BMT) unit.

Methods: In January of 2012 surveillance cultures for CRE and CRPa with selective medium with carbapenem were implemented in BMT unit, but surveillance cultures of feces samples for VRE were already performed routinely. Swabs of patients were collected weekly until discharge or positive result.

Results: A total of 200 patients (age mean 45 years, 107 (53.5%) males) underwent surveillance, with 1323 samples collected. 554 (41.8%) surveillance cultures for CRPa, 413 (31.2%) for VRE and 356 (27%) for CRE. Of these, 179 surveillance culture were positive (13.5%), with greater positivity for oropharynx (6, 35.3%) and rectal (17, 20.7%), as shown in Table 1. Infection due to multidrug-resistant (MDR) pathogens occurred in 52 (21.5%) patients, among them 45 (86.5%) were bacteremia and 12 (23%) had positive surveillance culture before infection.

Table 1. Characterization of positive samples for surveillance cultures of patients in a BMT unit

Positivity of surveillance cultures by site	179 (13.5%)
Axilla (n = 116)	16 (13.8%)

Feces (n = 1108)	140 (12.6%)
Oropharyx (n= 17)	6 (35.3%)
Rectum (n = 82)	17 (20.7%)
Mean length of stay until the first positive surveillance culture (days, range)	
CRE (n = 49)	17.9 (1 - 55)
CRPa (n = 31)	20.1 (4 - 39)
VRE (n = 46)	10.5 (0 - 40)
Mean number of surveillance cultures performed until the first positive (days, range)	
CRE	2 (1 - 6)
CRPa	2.7 (1 - 8)
VRE	1.7 (1 - 6)
Mean detection time to positivity surveillance cultures until infection due to MDR pathogens (days, range)	
CRE (n = 5)	21.4 (1-34)
CRPa (n = 7)	14.1 (1 - 35)

Conclusion: The most frequent MDR microorganism identified by surveillance culture was CRE. The body sites with highest positivity were oropharynx and rectum. The positive of surveillance culture was low before infection showing that its utility is questioned.

1624. A single genotype of multidrug resistant (MDR) Acinetobacter baumannii expresses multiple antibiotic susceptibility phenotypes

Part of Session: 188. Multidrug-Resistant Gram Negative Rods

TIMOTHY L. WIEMKEN, PHD, MPH, CIC[1], SUSAN RUDIN, BS[2], MICHAEL JACOBS, MD[3], ROBERT A. BONOMO, MD[2], ROBERT KELLEY, PHD[1], EMILY PACHOLSKI, MPHC[1] and JULIO RAMIREZ, MD[1]; [1]University of Louisville, Louisville, KY, [2]Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH, [3]Case Western Reserve University/University Hospitals of Cleveland, Cleveland, OH

Background:

In the absence of genetic fingerprinting data, it is common practice for infection preventionists and hospital epidemiologists to define, as a single genotype, bacteria with equal antibiotic susceptibility phenotypes. Evidence to support this practice of "predicting genotypes" based on antibiotic susceptibility phenotypes is scarce. The objective of this study was to describe the utility of using antibiotic susceptibility phenotypes to define a single genotype of MDR *Acinetobacter baumannii*.

Methods:

Clinical isolates were collected from patients infected or colonized with MDR *A. baumannii* from a long-term acute care hospital in Louisville, Kentucky. Broth microdilution in cation-adjusted Mueller-Hinton broth was used to determine the minimum inhibitory concentrations (MICs) for 21 antibiotics. Organisms with equal antibiotic susceptibility phenotypes were considered to correlate to a single "predicted genotype". REP-PCR was used to determine genotypes.

Results:

A total of 21 MDR *A. baumannii* isolates from a single genotype were included in the analysis. Based on antibiotic susceptibility phenotypes, a total of 15 "predicted genotypes" were identified. The maximum number of isolates with equal antibiotic susceptibility phenotypes was four.

Conclusion:

This study indicates that the antibiotic resistance phenotype does not predict the genotype of *A. baumannii*. During an outbreak investigation, the practice of predicting bacterial genotypes based on antimicrobial phenotypes should be discouraged.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

Poster Abstract Session:

191. Role of the Healthcare Environment in HAIs

Saturday: 12:30 p.m. - 2:00 p.m.
Room: The Moscone Center: Poster Hall C

Presenters:

1676 **Impact of the environment in the development of nosocomial norovirus infection in a bone marrow transplant unit**
ROGER ARAUJO-CASTILLO, M.D., CAROLYN D. ALONSO, M.D., BERNADETTE SULLIVAN, RN MBA, JAMES D. LEVINE, MD and SHARON B. WRIGHT, MD MPH; Beth Israel Deaconess Medical Center, Boston, MA

1677 **Impact of Environmental Care on Patient Outcomes**
XIAOYAN SONG, PHD, MBBS[1], JOHN BERGER, MD[2], LISA WILLIAMS, MHA, BSN, RNC, NE-BC[3] and ROBERTA DEBIASI, MD[1]; [1]George Washington University School of Medicine, Washington, DC, [2]George Washington University, Washington, DC, [3]Children's National Medical Center, Washington, DC

1679 **Reopening NYU Medical Center after Hurricane Sandy – Lessons Learned from an Infection Control Perspective**
RUVANDHI NATHAVITHARANA, MD, MPH[1], DONALD CHEN, MD[2], ALYCIA FOTI, BA[2], RANEKKA DEAN, RN[2], TANIA BUBB, RN[2], SANDRA HARDY, RN[2], ALEX ROWAN-HAZELRIGG, RN[2], STEVEN BOCK, RN[2], SCOTT CUTRO, MD[2], GABRIELA PINTO, BA[2], FAITH SKEETE, RN[2], ANNA STACHEL, MPH[2], JENNIFER LIGHTER, MD[2] and MICHAEL S. PHILLIPS, MD[2]; [1]NYU Medical Center, New York, NY, [2]NYU Langone Medical Center, New York, NY

1680 **Contamination of Hydrostatic Shock Controls with Legionella pneumophila in a Bone Marrow Transplant Unit**
ISI OBADAN, MD, MPH[1], DEBRA CAMPBELL[1], JOSEPH ALLEN, DSC, MPH[2], MATT FRAGALA, MS, CIH[2], JERRY LUDWIG, PHD, PE[2], ZITA MELVIN, RN, BSN, CIC[3], DEBORAH ANN MACK, RN, CIC[3] and RICHARD T. ELLISON III, MD[1]; [1]University of Massachusetts Medical School, Worcester, MA, [2]Environmental Health & Engineering, Inc., Needham, MA, [3]UMass Memorial Medical Center, Worcester, MA

1681 **Legionella pneumophila: Healthcare-associated Case with Positive Environmental Samples after 22 Years**
SYLVIA GARCIA-HOUCHINS, RN, MBA, CIC[1], SEAN CARIñO, MPH[1], CYNTHIA PEREZ, M(ASCP)[1], AUREA ENRIQUEZ, M(ASCP), CIC[1], MONA SHAH, BS[1], RACHEL MARRS, MSN, CIC[1], LAUREN SUCH, BS[1] and EMILY LANDON, MD[2]; [1]The University of Chicago Medicine, Chicago, IL, [2]University of Chicago, Chicago, IL

1682 **Use of Short Course Treatment for Disinfection of Legionella pneumophila in Hospital Water Supplies**
YUSEN LIN, PHD., MBA[1], HSIU-YUN SHIH, MS[1], YIJIN LIN, MS[1], REN-JR BEN, MD[2], YAO-SHEN CHEN, MD[3] and CHIH-HUAN CHUNG, MD[4]; [1]National Kaohsiung Normal University, Kaohsiung, Taiwan, [2]Kaohsiung Armed Forces General Hospital, Kaohsiung, Taiwan, [3]Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, [4]Kuo General Hospital, Tainan, Taiwan

1683 **Pseudo-outbreak of Mycobacterium gordonae following the opening of a new 304 bed building at a Chicago area medical center**
KAVITHA PRABAKER, MD[1], CHETHRA MUTHIAH, MD[1], MARY K. HAYDEN, MD, FSHEA,

FIDSA[2], ROBERT A. WEINSTEIN, MD, FIDSA, FSHEA[1], JYOTHIRMAI CHEERALA, MT(ASCP)[2], MARY LOU SCORZA, MT(ASCP)[2], JOHN SEGRETI, MD[2], MARY ALICE LAVIN, RN, MJ, CIC[2], BARBARA A. SCHMITT, RN[2], KATHLEEN G. BEAVIS, MD[3], SHARON F. WELBEL, MD[1] and GORDON M. TRENHOLME, MD[2]; [1]Cook County Health and Hospitals System, Chicago, IL, [2]Rush University Medical Center, Chicago, IL, [3]Stroger Hospital of Cook County, Chicago, IL

1684 **Bacterial Load and Diversity Survey in Hospital Water Distribution System**

CINDY LALANCETTE, PHD[1], EMILIE BéDARD, ING.[2], CéLINE LAFERRIèRE, MD[3], ERIC DéZIEL, PHD[1] and MICHèLE PRéVOST, PHD[2]; [1]INRS-Institut Armand Frappier, Laval, QC, Canada, [2]Polytechnique Montréal, NSERC Industrial Chair in Drinking Water, Montréal, QC, Canada, [3]CHU Sainte-Justine, Montréal, QC, Canada

1685 **Contamination of Environmental Surfaces with Antibiotic-Resistant Gram-Negative Bacteria (GNB) in Public Areas Surrounding New York City Hospitals**

MICHAEL ROSE, MD, DAVID LANDMAN, MD and JOHN QUALE, MD; SUNY Downstate Medical Center, Brooklyn, NY

1686 **Extraintestinal Pathogenic E. coli (ExPEC) Contaminating Public Restrooms (PRs)**

MUHANAD MOHAMED, MD[1], JAMES R. JOHNSON, MD[1], KRIS OWENS[2], ABBY GAJEWSKI[2] and MICHAEL A. KUSKOWSKI, PHD[3]; [1]University of Minnesota, Minneapolis, MN, [2]Veterans Affairs Medical Center, Minneapolis, MN, [3]Minneapolis Veterans Affairs Healthcare System, Minneapolis, MN

1687 **Measuring contact patterns within a hemodialysis center using sensor networks to understand routes of disease transmission**

PHILIP M. POLGREEN, MD[1], ALBERTO SEGRE, PHD[2], MANISH SUNEJA, MD[2], JERRY FANGMAN[2], MATTHEW WISE, PHD[3], KATHERINE ELLINGSON, PHD[4], PRITI PATEL, MD, MPH[3] and TED HERMAN, PHD[2]; [1]University of Iowa Carver College of Medicine, Iowa City, IA, [2]University of Iowa, Iowa City, IA, [3]Centers for Disease Control and Prevention, Atlanta, GA, [4]Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, GA

1688 **Extended Survival of Carbapenem-resistant Enterobacteriaceae (CRE) on Dry Surfaces**

NANCY L. HAVILL, MT(ASCP), CIC[1], JOHN M. BOYCE, MD, FIDSA[1] and JONATHAN A OTTER, PHD[2]; [1]Yale-New Haven Hospital, New Haven, CT, [2]Bioquell, Andover, United Kingdom

1689 **Where do they hide and what is the impact on patient colonisation? Identification of environmental reservoirs of antimicrobial resistant bacteria in a general intensive care unit**

HéLèNE MCDERMOTT, MB, BCH, BAO, MRCPI, FRCPATH[1], DEIRDRE FITZGERALD-HUGHES, PHD[1], HILARY HUMPHREYS, MB, BCH, BAO, MRCPI, FRCPATH, MD[2] and MAIREAD SCALLY, BSC, MSC,[2]; [1]Royal College of Surgeons of Ireland, Dublin, Ireland, [2]Beaumont Hospital, Dublin, Ireland

1690 **Comparison of Methicillin-Resistant Staphylococcus aureus Contamination Rates of Medication Cabinets Between Isolation and Non-Isolation Rooms**

HOLLY KIRK, PHARM.D.[1], RODNEY BRIGG TURNER, PHARM.D.[2], MICHAEL SWEET, PHARM.D.[2], DOUGLAS SLAIN, PHARM.D., FCCP[3], ROCCO LASALA, M.D.[3] and RASHIDA KHAKOO, MD, MACP[4]; [1]West Virginia Univeristy Healthcare, Morgantown, WV, [2]West Virginia University Healthcare, Morgantown, WV, [3]West Virginia University, Morgantown, WV, [4]West Virginia University Section of Infectious Diseases, Morgantown, WV

1691 **Quantitative Assessment of Interactions between Hospitalized Patients and Portable Medical Equipment and Other Fomites**

NUNTRA SUWANTARAT, MD[1], LAURA SUPPLE[2], ANNETTE JENCSON, BSMT(ASCP)SM, CIC[2], THRIVEEN MANA, M.S., MBA[3], JENNIFER CADNUM, B.S.[2] and CURTIS J. DONSKEY, MD[2]; [1]University Hospitals Case Medical Center, Cleveland, OH, [2]Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH, [3]Case Western Reserve University, Cleveland, OH

1692 **Surface Microbiology of the iPad Tablet Computer and the Potential to Serve as a Fomite**

ELIZABETH HIRSCH, PHARMD, BCPS, **JASON LANCASTER, PHARMD, MED, BCPS**, BRIAN RAUX, RACHAEL MANN and STEVEN LEONARD, PHARMD; Northeastern University, Boston, MA

1693 **Use of Portable Electronic Devices in Hospitals : a Reservoir for Healthcare Pathogens**

AMBER KHAN, M.D.[1], AMITHA RAO, M.D.[2], CARLOS REYES-SACIN, MD[3], KAYOKO HAYAKAWA, M.D., PHD[3], KEITH KAYE, MD, MPH, FIDSA, FSHEA[4], KATHLEEN RIEDERER, BS, MT[5], JOEL FISHBAIN, MD[5] and DIANE LEVINE, M.D.[1]; [1]Detroit Medical Center / Wayne State University, Detroit, MI, [2]St John Hospital and Medical Center, Grosse Pointe Woods, MI, [3]Detroit Medical Center (DMC) / Wayne State University, Detroit, MI, [4]Detroit Medical Center/ Wayne State University, Detroit, MI, [5]St. John Hospital and Medical Center, Grosse Pointe Woods, MI

1694 **A novel agent to decrease contamination on hospital scrubs**

MALLORY BOUTIN, BA, MPH, **KERRI THOM, MD, MS**, MIN ZHAN and J. KRISTIE JOHNSON, PHD; University of Maryland School of Medicine, Baltimore, MD

1695 **Universal Gowning and Gloving Reduces Health Care Worker Clothing Contamination**

CALVIN WILLIAMS, MD, PHD[1], PATTY MCGRAW, RN, MS[1], ELYSE SCHNECK, BSMT (ASCP)[1], JESSE JACOB, MD[2], DEANNA MURRAY, MPH[2], DANIELA MORENO, B.S.[3], MARCUS ZERVOS, MD[3], GALO CUBILLOS, MD[4], DANIEL H. KETT, M.D.[5], RONALD ESTRELLA, BSN, CCRN[6], DANIEL MORGAN, MD, MS[7], ANTHONY HARRIS, MD, MPH[7] and MARCI DREES, MD, MS[1]; [1]Christiana Care Health System, Newark, DE, [2]Emory University School of Medicine, Atlanta, GA, [3]Henry Ford Hospital, Detroit, MI, [4]Miller School of Medicine at the University of Miami, Miami, FL, [5]University of Miami/ Jackson Memorial Hospital, Miami, FL, [6]University Health System, San Antonio, San Antonio, TX, [7]University of Maryland School of Medicine, Baltimore, MD

1696 **Are you wearing your gown correctly? An assessment of proper gowning when entering a contact isolation room**

SARA REESE, PHD[1], HEATHER YOUNG, MD[2] and CONNIE PRICE, MD[2]; [1]Denver Health and Hospital Authority, Denver, CO, [2]Denver Health Medical Center, Denver, CO

1697 **The Case for Standard Precautions**

ANGELA VASSALLO, MPH, MS[1], NANCY PARRIS, MSN[2], LIEN HUA-FENG, MSN[1], DAWNA HENDEL, MSN[1], ROBERT WINTERS, MD[1], MELVIN SCHEER, MD[1], JOHN ROBERTSON, MD[1] and ELLIE GOLDSTEIN, MD, FIDSA, FSHEA[3]; [1]Saint John's Health Center, Santa Monica, CA, [2]Providence Saint Joseph Medical Center, Burbank, CA, [3]RM Alden Research Laboratory, Santa Monica, CA

1698 **Environmental cleaning practices – results of environmental services (EVS) management survey**

TAL MANN, MD[1], SALAH QUTAISHAT, PHD, CIC, FSHEA[2], ELAINE FLANAGAN, BSN, MSA[3],

KEITH COTTRELL[4], SORABH DHAR, MD[5], PREETHY SAMUEL, PHD[6] and KEITH KAYE, MD, MPH, FIDSA, FSHEA[3]; [1]Detroit Medical Center (DMC)/ Wayne State University, Detroit, MI, [2]Diversey, Inc., Sturtevant, WI, [3]Detroit Medical Center/ Wayne State University, Detroit, MI, [4]Environmental Services Crothall Healthcare, NA, MI, [5]Detroit Medical Center (DMC) / Wayne State University, Detroit, MI, [6]Wayne State University, Detroit, MI

1699 **Outbreak Investigation into an Increased Incidence of Non-tuberculous Mycobacterium in Sputum Cultures in Pediatric Blood and Marrow Transplant Patients**

SUSAN KLINE, MD, MPH; University of Minnesota Medical School, Minneapolis, MN, AMANDA GUSPIEL, MPH; University of MN Medical Center, Fairview and Unviersity of MN Amplatz Children's Hospital, Minneapolis, MN, CHRISTINE HENDRICKSON, RN, BSHA; University of Minnesota Medical Center , Fairview and University of Minnesota Amplatz Children's Hospital, Minneapolis, MN, ANDREW STREIFEL, MA; University of Minnesota, Minneapolis, MN and GINGER WARD, RN, BSN, CCM; University of Minnesota Amplatz Children's Hospital, Minneapolis, MN

1700 **Occurrence of MRSA, Enteric and Spore forming Bacteria on Fomites in Hospital Cafeterias: Impact of Hydrogen Peroxide Wipes**

CHARLES GERBA, PH.D. and SHERI MAXWELL, BS; University of Arizona, Tucson, AZ

1701 **Comparing Cleaning and Disinfection using the Traditional Cloth and Bucket Method versus the Ready to Use Wipe Method: Process Compliance and Time-Related Costs**

TIMOTHY L. WIEMKEN, PHD, MPH, CIC[1], EMILY PACHOLSKI, MPHC[1], ROBERT KELLEY, PHD[1], JUANITA CLAY, MSN, RN[2], KIMBERLY DANIELS, RN[2], MICHAEL BROMILOW[2] and JULIO RAMIREZ, MD[1]; [1]University of Louisville, Louisville, KY, [2]Kindred Healthcare, Louisville, KY

1702 **Evaluation of a Soft Surface Sanitizer in Healthcare Environments**

KELLY REYNOLDS, PHD; University of Arizona, Tucson, AZ and JONATHAN SEXTON, PHD; The University of Arizona, Tucson, AZ

1703 **Comparing the Clinical Effectiveness of Surface Disinfectants**

PHILIP C. CARLING, MD, FSHEA; Boston University School of Medicine, Boston, MA, JOANN FERGUSON, RN, BAN; Norh Memorial Medical Center/Maple Grove Hospital, Maple Grove, MN, ANITA THOMASSER, BS; Ecolab, Eagan, MN and JENNIFER PERKINS, BS MBA; Maple Grove Hospital, Maple Grove, MN

1704 **How clean is clean?**

MOI LIN LING, MBBS, FRCPA, CPHQ, MBA, KWEE YUEN TAN, BSC and AMANDA PANG; Singapore General Hospital, Singapore, Singapore

1705 **Re-Assessing the Relationship Between Aerobic Colony Counts (ACC) and Adenosine Triphosphate (ATP) Bioluminescence Assays When Sampling Environmental Surfaces in Hospital Settings**

JOHN M. BOYCE, MD, FIDSA, NANCY L. HAVILL, MT(ASCP), CIC and RENEE FEKIETA, PHD; Yale-New Haven Hospital, New Haven, CT

1706 **Ultraviolet Light for Terminal Disinfection of Neonatal Incubators**

MICHELLE POWER, BSMT (ASCP)[1], SAROJINI MISRA, MS, SM (ASCP), SM (AAM)[1], JASON FUNYAK[1], BONNIE CHAVEZ, BSN, RNC-NIC[1], JOHN STEFANO, MD[2], DEBORAH TUTTLE, MD[1] and MARCI DREES, MD, MS[1]; [1]Christiana Care Health System, Newark, DE, [2]Jefferson Medical College, Philadelphia, PA

1707 **Hydrogen peroxide vapor (HPV) room disinfection significantly reduces the rate of C. Difficile infection**

KIMBERLY HORN, RN, BS, MPH, CIC; Flagstaff Medical Center, Flagstaff, AZ

1708 **Inter-hospital Variation in Time Required for Hospital Room Ultraviolet (UV)-C Irradiation: Preliminary Experience from the Benefits of Enhanced Terminal Room (BETR) Disinfection Study**

DEVERICK J. ANDERSON, MD, MPH[1], WILLIAM RUTALA, PHD, FSHEA[2], LAUREN KNELSON, MSPH[1], REBEKAH W. MOEHRING, MD, MPH[1], LUKE F. CHEN, MBBS, MPH, CIC, FRACP[1], DAVID J. WEBER, MD, MPH, FIDSA, FSHEA[2], DANIEL J. SEXTON, MD, FIDSA[1] and THE CDC PREVENTION EPICENTERS PROGRAM; [1]Duke University Medical Center, Durham, NC, [2]University of North Carolina Health Care, Chapel Hill, NC

1709 **Efficacy of Commercially Available Antimicrobial Copper Surfaces Against Common Nosocomial Pathogens**

DANIEL Z. USLAN, MD, MS[1], JANET A. HINDLER, MCLS, MT[2], ROMNEY M. HUMPHRIES, PH.D.[3], EVELYN ALVAREZ, MPH[4], MYRA MALDANADO[2], PETER SINSHEIMER, PH.D, MPH[5], VIJAY GUPTA, PH.D,[6], DAT HUYNH[7], RONALD BROOKMEYER, PH.D[7] and NEETHA ABRAHAM, MBA, MS[1]; [1]David Geffen School of Medicine/University of California, Los Angeles, Los Angeles, CA, [2]Department of Pathology and Laboratory Medicine, University of California, Los Angeles, Los Angeles, CA, [3]University of California, Los Angeles, Los Angeles, CA, [4]UCLA Fielding School of Public Health, Los anageles, CA, [5]UCLA Fielding School of Public Health, Los Angeles, CA, [6]UCLA Henry Samueli School of Engineering & Applied Science, Los Angeles, CA, [7]UCLA Fielding School of Public Health, Los angeles, CA

1710 **Environmental Contamination by Patients Infected or Colonized with MRSA or VRE: A multicenter study**

LAUREN KNELSON, MSPH[1], DAVID A. WILLIAMS, RN, BSN, IP[2], MARIA GERGEN[2], WILLIAM RUTALA, PHD, FSHEA[2], DAVID J. WEBER, MD, MPH, FIDSA, FSHEA[3], DANIEL J. SEXTON, MD, FIDSA[1], DEVERICK J. ANDERSON, MD, MPH[4] and CDC PREVENTION EPICENTERS PROGRAM; [1]Duke University Medical Center, Durham, NC, [2]University of North Carolina Health Care, Chapel Hill, NC, [3]University of North Carolina At Chapel Hill, Chapel Hill, NC, [4]Duke Infection Control Outreach Network, Duke University Medical Center, Durham, NC

1711 **How do you bed bathe your patients? The variations in bed bathing methods among healthcare personnel**

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Session #191 Presentations:

1676. Impact of the environment in the development of nosocomial norovirus infection in a bone marrow transplant unit

Part of Session: 191. Role of the Healthcare Environment in HAIs

ROGER ARAUJO-CASTILLO, M.D., CAROLYN D. ALONSO, M.D., BERNADETTE SULLIVAN, RN MBA, JAMES D. LEVINE, MD and SHARON B. WRIGHT, MD MPH; Beth Israel Deaconess Medical Center, Boston, MA

Background: Norovirus infection has been increasingly recognized as an important cause of diarrhea in hematopoietic stem cell transplant (HSCT) patients. In 2012, a cluster of nosocomial norovirus infections was detected in our 28 bed Bone Marrow Transplant (BMT) unit that houses patients with all types of hematological malignancies. We sought to identify potentially modifiable patient and institutional risk factors in order to prevent future infections.

Methods: A retrospective case-cohort study was performed among all patients admitted to our BMT unit from Jan – May 2012. Cases were defined as patients who developed ≥ 3 loose stools per day with or without vomiting for ≥48 hours duration with a positive norovirus stool EIA. Patients with other gastrointestinal infections were excluded. Demographic, clinical, pharmacy, laboratory and radiographic data were abstracted from the medical records. Univariate analyses were performed using Fisher's exact test; all analyses were performed using STATA v.12.0.

Results: Among the cohort of 149 patients, 7 cases were identified. 5 cases occurred during the 3 week period from 1/24 - 2/11/12 followed by single cases in March and May. 57.5% (4/7) of cases were male with an average age of 60.1 years. All cases had a hematologic malignancy including: lymphoma (3), leukemia (2), multiple myeloma (MM) (1) and myelodysplastic syndrome (MDS) (1); 2 had undergone BMT. There was no significant difference in the type of malignancy, transplant status or presence of graft versus host disease. Cases were more likely to have received steroids than the rest of the cohort (100% vs. 73.9%, p=0.12). 2 cases were admitted to the ICU for complications of norovirus and 1 expired (case fatality rate of 14.3%). Of the cases, 3 (42.9%) resided in a room previously used by the index patient compared with 11.3% (16/142) of the rest of the cohort (p=0.04).

Conclusion: We describe a cluster of nosocomial norovirus infections in a BMT unit with significant morbidity and mortality. In our single center study, steroid use was associated with nosocomial norovirus infection but did not reach statistical significance. One patient room was significantly associated with infection in subsequent patients suggesting the importance of environmental cleaning in prevention efforts.

1677. Impact of Environmental Care on Patient Outcomes

Part of Session: 191. Role of the Healthcare Environment in HAIs

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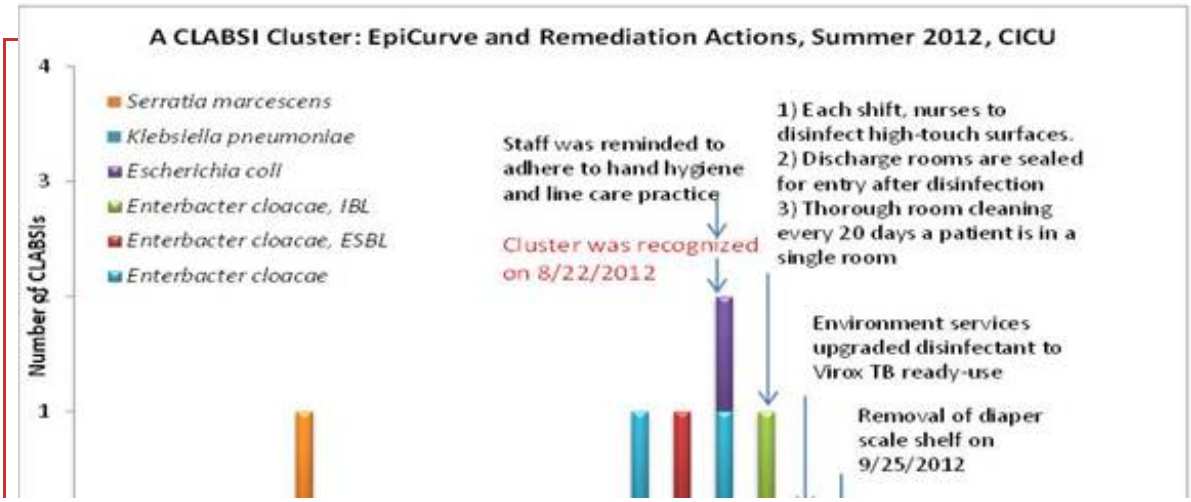
Background: A clean environment is essential for hospitals to deliver safe patient care. On 12/28/2011, our cardiac intensive care unit (CICU) moved into a newly constructed space. On 8/21/2012, the unit recognized three central line associated bloodstream infections (CLABSIs) within four weeks, caused by enteric organisms. This was in stark contrast to the existing baseline of 1 CLABSI every three months from varied pathogens. This rise in the incidence of CLABSIs was only noted in CICU.

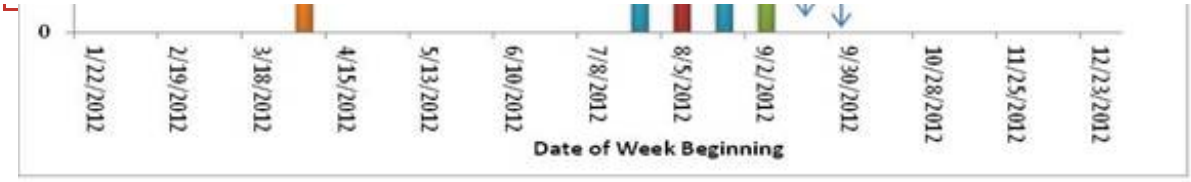
Methods: This observational study was carried out in the summer 2012. Medical charts were reviewed for patients with CLABSI caused by enteric pathogens. Environmental surface hygiene was monitored monthly by testing 10 frequently touched surfaces in two discharge rooms by measuring surface Adenosine-5'-triphosphate (ATP) level.

Results: Five patients developed five CLABSIs caused by *Enterobacter (E.) cloacae* (3), *E. cloacae*, ESBL (1), *Klebsiella pneumonia*, ESBL (1), and *E.coli* (1) between 7/28/2012 and 9/9/2012. Chart review found no commonalities among these 5 patients regarding central line type, dwelling time, age, underlying disease, surgical history, or care providers. Compared to the baseline period (1/2012 – 4/2012), clean environmental surfaces fell from 95% to 47% in August. The dispenser for mixing the chemical solutions used to clean the unit was found to be malfunctioning. Additionally a construction flaw was discovered in which the clean supply cabinet was not completely isolated from a diaper scale shelf that has a shallow space prohibiting thorough disinfection. The cluster was interrupted by improving environmental surface hygiene and staff hand hygiene re-education (implemented on 8/22/2012), replacing disinfectant with the ready-to-use solution (implemented on 9/14/2012), and removing diaper scale shelves (implemented 9/25/2012) until the supply cabinet was modified (Figure). The unit has had zero CLABSI after 9/9/2012.

Conclusion: This investigation revealed that systematic audits of environmental surface hygiene can detect environmental issues with direct impact on patient outcomes. It also highlights the importance of post-construction evaluation for optimizing patient care environment.



Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.



1679. Reopening NYU Medical Center after Hurricane Sandy – Lessons Learned from an Infection Control Perspective

Part of Session: 191. Role of the Healthcare Environment in HAIs

RUVANDHI NATHAVITHARANA, MD, MPH[1], DONALD CHEN, MD[2], ALYCIA FOTI, BA[2], RANEKKA DEAN, RN[2], TANIA BUBB, RN[2], SANDRA HARDY, RN[2], ALEX ROWAN-HAZELRIGG, RN[2], STEVEN BOCK, RN[2], SCOTT CUTRO, MD[2], GABRIELA PINTO, BA[2], FAITH SKEETE, RN[2], ANNA STACHEL, MPH[2], JENNIFER LIGHTER, MD[2] and MICHAEL S. PHILLIPS, MD[2]; [1]NYU Medical Center, New York, NY, [2]NYU Langone Medical Center, New York, NY

Background:

After Hurricane Sandy struck New York on 29thOctober 2012, NYU Medical Center sustained extensive water and wind damage. The infection prevention and control (IPC) team played an integral role in efforts to safely reopen and reoccupy the facility. Particular concerns included ensuring the safety of workers involved in the hurricane response and cleanup as well as the potential infection risk from airborne or waterborne pathogens in the environment, especially considering our immunocompromised patient populations.

Methods:

In the immediate aftermath of the storm, we developed checklists and dispatched IPC practitioners to conduct detailed surveys of inpatient units and outpatient sites. Based on available literature and assessment of our immediate needs, we developed a comprehensive approach to remediation and reopening including: standardized assessment of equipment and supplies, evaluation of the HVAC systems, unit re-occupancy checklists, ensuring appropriate personal protective equipment for workers, surveillance for worker illness and clinical surveillance of infections due to invasive molds or waterborne bacteria.

Results:

The surveillance of inpatient units at NYU Langone Medical Center included assessment of HVAC systems damage, performing air and duct cultures for molds, hyperchlorination and testing of water supplies for Legionella and detailed inspection of supplies affected by water damage. We screened >80 workers present on the night of the storm through employee health, fit tested >200 workers, and in subsequent weeks obtained >400 tests for duct cleanliness, completed >30 checklists for reopening units, conducted duct tests post-cleaning, and monitored clinical cultures for two months after re-opening.

Conclusion:

There is limited literature regarding practical approaches to the mitigation of damage to healthcare facilities after natural disasters. Particular challenges encountered were the approach to damaged supplies, requiring careful risk assessments, and the need to ensure adequate pressurization of rooms after storm damage. After a catastrophic event, we took a systematic approach to guide the safe reopening of a complex medical facility and hope our practical perspective and insights will prove informative and instructive to others.

1680. Contamination of Hydrostatic Shock Controls with Legionella pneumophila in a Bone Marrow Transplant Unit

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Legionellosis is a major concern for stem cell transplant recipients, and the Foundation for Accreditation of Cellular Therapy (FACT) has recommended periodic testing of water for the pathogen in Bone Marrow transplant units (BMTUs). Shortly after a newly constructed BMTU was opened at the UMass Memorial Medical Center, a routine surveillance

culture identified *Legionella pneumophila* serogroup 1 (*L. pneumophila*) from a shower sample (60 cfu/ml). Although there had been no clinical cases of Legionellosis, 0.2 micron water filters were installed at each outlet throughout the BMTU and an investigation was initiated.

Methods: Water samples were collected in 250 ml bottles treated with sodium thiosulfate to neutralize any residual disinfectant. Swab samples were collected and transported in sterile polypropylene bottles. *Legionella*culture was performed by PathCon Laboratories (Norcross, Georgia).

Results: Cultures performed on specimens from all water outlets in the BMTU (n=36) identified *L. pneumophila* in 3 of 8 showers and 1 of 8 sinks (maximum concentration = 780 cfu/ml). Hot water tanks serving the BMTU tested negative. Chlorine concentrations, temperatures and pH levels in BMTU water outlets were appropriate, and no positive cultures were identified at 60 sites outside the BMTU. Despite initiating a water system flushing protocol in the BMTU and disinfecting shower heads/sink aerators, follow up cultures (n=60) 1 month later still identified *L. pneumophila* in 6 sites. A review of the BMTU plumbing system revealed newly installed electronic faucets and hydrostatic shock controls; upon sampling, 1 of 8 hydrostatic shock controls showed colonization with *L. pneumophila* serogroup 1, with the highest microbial concentration (400 cfu/swab) noted within the bellows. Retesting in the BMTU 29 days after removal of contaminated hydrostatic shock controls alongside ongoing water system flushes found 1 positive culture (1 cfu/ml) from a sink sample. 11 other samples from water outlets in that same area all tested negative, including 6 locations that were positive prior to removal of the contaminated hydrostatic shock controls.

Conclusion: Hydrostatic shock controls that may be installed concurrently with electronic faucets can serve as reservoirs for *L. pneumophila*.

1681. Legionella pneumophila: Healthcare-associated Case with Positive Environmental Samples after 22 Years

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: UCM has had an aggressive Legionella prevention and control program since 1988. Control measures have included periodic cultures of the domestic water and investigation of all Legionella culture or antigen positive results for possible healthcare links. In 1991, after 3 years of super-heating, the facility installed a hyper-chlorination system in the domestic hot water system (1-3 PPM free chlorine). In the ensuing 22 years sporadic cases of possible Legionella infection have been investigated with 1 case in 1993 that was linked to low chlorine levels but resulted in no positive environmental cultures. In February 2013, a confirmed case of healthcare acquired Legionella was identified in an Oncology patient 33 days after admission. Immediate investigation was performed including cultures of the domestic water system.

Methods: Standard laboratory methods for identification of *Legionella pneumophila* were used.

Results: Water samples from the patient's shower yielded <100 cfu/ml *Legionella pneumophila* with free chlorine of 1.1 ppm. Further investigation prompted cultures of the showerhead o-rings, residual water left in the shower hose, the first 200 mls of water from the pipe after the showerhead was removed, and hot water from the shower pipe after 3 minutes. Cultures were obtained from multiple patient rooms on the same unit and on units with other models of shower heads. O-rings and residual water left in the shower hose (post o-ring) were positive for *Legionella pneumophila*. Additional patient showers in the main inpatient building were cultured and low levels of *Legionella pneumophila* were sporadically identified. Further testing of these showers identified *Legionella pneumophila* in the o-rings but not the water pipe or domestic hot water system. Five predominant models of showerheads were in use and *Legionella pneumophila* was recovered from the o-rings of 4 models. As a control measure all of the showerheads were replaced and all subsequent water samples have been negative for *Legionella pneumophila*.

Conclusion: Approaches to culturing domestic hot water systems must take into account the terminal source as well as the main system. Legionella control measures when the free chlorine level is controlled and water is negative may need to include routine replacement of showerheads.

1682. Use of Short Course Treatment for Disinfection of Legionella pneumophila in Hospital Water Supplies

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Disinfection of hospital water supplies has been an effective method in eradicating waterborne pathogens for prevention of waterborne-associated nosocomial infections. Chlorine dioxide has been applied to hospital water treatment for eradication of Legionella. However, due to the cost and fluctuation of ClO2 concentration in water, long-term efficacy varies from literatures. We propose a short course treatment of chlorine dioxide (<1 month) as an alternative, instead of superheat/flush or hyperchlorination, for Legionella eradication. **Methods:** The study hospital experienced Legionella colonization in the water system (positivity rate 7.1% ~ 35.7%) from routine surveillance cultures. A ClO2 generator (@80g/h by DexGerm Co., Ltd.) was installed at the cold water supply to the test building. We used ON period and OFF period to describe whether the ClO2 was injecting to the water system. Routine environmental cultures and ClO2 concentration testing were performed to evaluate the efficacy. Water samples (hot and cold water mixture @300 mL) were collected for Legionella numeration by a standardized culture method (ISO 11731-2:2004). **Results:** Two episodes of short course ClO2 treatment were conducted. During the first treatment (ON period) in Jan 2013, the distal site positivity for Legionella decreased from 28.6% to 0% one month after the activation of ClO2 injection at concentration targeted at 0.3mg/L. When the ClO2 injector was turned off for 1 month, the followup culture (OFF period) in Feb 2013 remained low at 7.1% site positive. When the ClO2 injector was reactivated again for 1 month, the distal site positivity remained low (7.1%) in Mar 2013 cultures (On period). **Conclusion:** By short course treatment using ClO2, we could control the Legionella colonization rate in the test building. Short course ClO2 treatment provides a cost effective alternative with minimal adverse effects to superheat/flush and hyperchlorination to eradicate Legionella in hospital water system. Further studies are currently conducting to determine whether the OFF period can be extended so ClO2 injection can be minimized yet control Legionella colonization at a low risk level.

1683. Pseudo-outbreak of Mycobacterium gordonae following the opening of a new 304 bed building at a Chicago area medical center

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

In the first 7 months after opening a new building at our medical center, the prevalence of *Mycobacterium gordonae* (*Mg*) in clinical specimens increased from 0.4% to 1.1%. As isolates did not appear to represent clinical disease or laboratory contamination, evaluation for sources of contamination led to water reservoirs created in the new water distribution system during building construction.

Methods:

We collected samples from randomly selected potable water sources in patient rooms and common areas, from all ice machines, and from rooms previously occupied by patients with *Mg*-positive cultures in the new building and the old hospital. 0.5 ml samples were inoculated to Bactec™ MGIT™ 960 Mycobacterial Detection System and Middlebrook 7H10 agar (to allow colony counts) and incubated for 8 weeks. Kinyoun-positive colonies were identified presumptively by morphology and counted. A subset was identified to species.

Results:

The overall prevalence of mycobacteria in water samples was 244/268 (91%). *Mg* was ubiquitous in the new building [96/97 (99%)], compared to the old hospital [80/95 (84.2%), p<0.001]. No increase in prevalence of *Mg* was noted in rooms previously occupied by *Mg*-positive patients [47/48 (97.9%) vs 176/192 (91.7%), p=0.207]. Prevalence of *Mg* was significantly lower in water collected from ice machines [18/28 (64.3%)] compared to water collected from sinks and showers in patient rooms and sinks in common areas [226/240 (94%), p<0.001]. Median number of colony forming units of *Mg* in positive water samples was higher (186 vs 50 per ml, p<0.001) and proportion of water samples with >500 colonies/ml *Mg* was greater [17/95 (17.9%) vs 6/77 (7.8%), p=0.071] in the new building compared to the old hospital. Of 24 patients with *Mg*-positive clinical cultures, 20 (83.3%) were housed in the new building; 31/34 (91.2%) positive cultures

(sputum, bronchoalveolar lavage, gastric aspirate) had potential for water contamination.

Conclusion:

The pseudo-outbreak of *Mg* was likely due to an increased prevalence and concentration of *Mg* in the new building water supply. Further investigation should focus on aspects of new hospital construction that may have led to an increased burden of *Mg* in potable water and protective factors associated with ice machines.

1684. Bacterial Load and Diversity Survey in Hospital Water Distribution System

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Conditions prevailing in premise plumbing are often favourable to microbial growth. *Legionella pneumophila* , *Pseudomonas aeruginosa* and other opportunists present and amplified in hospital water system are a source of healthcare associated infections. We present results of water sampling from a university tertiary care hospital targeting the sites of amplification. The objectives were to: (1) conduct a bacterial diversity survey in a hospital water system, (2) identify risk areas for bacterial amplification through water bacterial load assessments, and (3) evaluate if amplification is local or system-wide within the water distribution system.

Methods: Bacterial diversity in samples from eight representative sites in the water distribution system was estimated by tag-encoded FLX amplicon pyrosequencing (TEFAP). Bacterial load sampling was performed on first flush through successive volumes of the first ten liters. Heterotrophic plate counts (HPC) were determined at 22°C, after 7 day incubation. Viable and total bacterial counts were assessed by fluorescence microscopy using BacLight™ staining. Selective cultures and qPCR were used to assess the presence of *L. pneumophila* and *P. aeruginosa*.

Results: Results demonstrated $\leq 10^4$ bact./ml in municipal water compared to 10-100X higher total viable counts in all other sampling points, with significant clinical opportunists ranging from 1.1×10^4 to 1.1×10^5 bact./ml. Sequential sampling results consistently showed a 1-to-2 log drop in total bacterial load after flushing the first 500 ml. In cold water, local amplification was observed with bacterial load continuing to decrease after five liters sampled whereas bacterial load leveled out after one liter in hot water, indicative of a persistent amplification within the latter distribution system.

Conclusion: Amplification of several clinically relevant bacteria within the internal water components of a hospital building was observed. Results from the sequential sampling show the potential benefit of an initial 500 ml flush in order to reduce water bacterial load at point-of-use, especially in cold water where amplification is local. In hot water, understanding factors leading to a system-wide amplification will be critical.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1685. Contamination of Environmental Surfaces with Antibiotic-Resistant Gram-Negative Bacteria (GNB) in Public Areas Surrounding New York City Hospitals

Part of Session: 191. Role of the Healthcare Environment in HAIs

MICHAEL ROSE, MD, DAVID LANDMAN, MD and JOHN QUALE, MD; SUNY Downstate Medical Center, Brooklyn, NY

Background: Hospital visitors, patients and staff often visit neighboring businesses, creating the potential for contamination of doorknobs and other surfaces with hospital flora.

Methods: Swabs were obtained from environmental surfaces in hospital lobbies and from nearby businesses and subway stations within a 1 mile radius of 6 New York City hospitals. As a control, cultures were taken from environmental surfaces >1.5 miles from any hospital. The swabs were cultured in selective media containing ceftazidime 2 µg/ml. Isolates were identified using API20E and 20NE and MICs performed by the agar-dilution method. Screening for the β-lactamases TEM, SHV, CTX, KPC, NDM, IMP, VIM, and OXA23,24,48 and 58 was done by PCR.

Results: 493 swabs were collected, mostly from doors (70%) of local businesses. 70/493 (14%) samples grew GNB. *Acinetobacter baumannii* (AB) was recovered in 15 samples, including 10 from doors of surrounding businesses. AB was identified in 15/336 (4.5%) swabs from ≤0.5 miles of the hospitals vs. 0/153 (0%) from ≥0.6 miles (P=0.004), including none from the control sites. All AB had a ceftazidime MIC > 4 µg/ml, and one was resistant to carbapenems. 10/15 AB isolates were clonally related by rep-PCR and were also related to known clinical isolates from one surveyed hospital. Cephalosporin-resistant *Citrobacter freundii* (n=3) and *E. coli* (n=2) were also recovered from environmental surfaces near hospitals, but not from the control sites. Other commonly recovered bacteria included *Pseudomonas fluorescens* (n=16), *Burkholderia cepacia* (n=15), and *Alcaligenes faecalis* (n=14). One isolate of *Stenotrophomonas maltophilia* was found to harbor an integron-associated VIM-2.

Conclusion: Cephalosporin-resistant GNB, including AB and Enterobacteriaceae, can be recovered from doors and other environmental surfaces surrounding hospitals in New York City. Hand hygiene measures should be considered for everyone exiting hospitals. The finding of VIM-2 in our region is disconcerting, and further vigilance is warranted.

1686. Extraintestinal Pathogenic E. coli (ExPEC) Contaminating Public Restrooms (PRs)

Part of Session: 191. Role of the Healthcare Environment in HAIs

MUHANAD MOHAMED, MD[1], JAMES R. JOHNSON, MD[1], KRIS OWENS[2], ABBY GAJEWSKI[2] and MICHAEL A. KUSKOWSKI, PHD[3]; [1]University of Minnesota, Minneapolis, MN, [2]Veterans Affairs Medical Center, Minneapolis, MN, [3]Minneapolis Veterans Affairs Healthcare System, Minneapolis, MN

Background: ExPEC is a major cause of urinary and other extraintestinal infections. Clarification of the modes of transmission of ExPEC within the population is crucial for preventing morbid and costly ExPEC infections. We studied PRs for the prevalence of contamination with *E. coli* and ExPEC, overall and according to location, gender, cleanliness, and sampling site.

Methods: 56 PRs in the Minneapolis-St. Paul area, including 10 each from 5 categories (fast food [FF], gas station [GS], public parks [PP], supermarkets [SM], and the Veterans Affairs Medical Center (VA)) and 6 in malls/stores (M/S), underwent one-time culture surveillance. 20 swab samples per PR were collected from diverse sites considered likely (i) to have fecal contamination or (ii) to be touched with bare hands (total n = 1120). Presence of presumptive fecal material at each site was recorded, as was the PR's gender status and overall cleanliness level. Swabs were incubated overnight in broth containing a fluorescent indicator. Turbid broths that fluoresced were streaked to eosin-methylene blue (EMB) agar. A single *E. coli* colony per positive sample, plus mixed Gram-negative growth, underwent a PCR-based ExPEC screen.

Results: Of 1120 samples, 168 (15%) fluoresced, 26 (2.3%) had *E. coli*, and 9 (0.8%) had ExPEC. Fecal-like material predicted fluorescence (P = 0.004) and *E. coli* (P <0.001) but not ExPEC (P > 0.05). Samples from female vs. male vs. unisex PRs, respectively, differed for the prevalence of fluorescence (16%, 10%, & 17.5%: P 0.03) and *E. coli* (3.6%, 1.5%, & 0.4%: P 0.008), but not ExPEC (1%, 1.2%, & 0%: P > 0.05). Toilet-associated sites were associated with fluorescence (18% vs. 12.1%: P = 0.006), *E. coli* (4.4% vs. 0.3%: P < 0.001), and ExPEC (1.5% vs. 0.2%: P = 0.02). PR type was associated with fluorescence (FF 17.5%, GS 13%, M/S 15%, PP 24%, SM 10%, VA 10.5%: P 0.001) but not *E. coli* or ExPEC. Cleanliness level was not predictive.

Conclusion: PRs are contaminated sporadicically with *E. coli* and ExPEC, in both expected and unexpected ways in relation to characteristics of the restroom and sampling site. Although presence of ExPEC corresponded significantly only with toilet-associated sites, several other sites yielded ExPEC. These data support PRs as facilitating dissemination of ExPEC within the population and urge cautious hygiene.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1687. Measuring contact patterns within a hemodialysis center using sensor networks to understand routes of disease transmission

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Healthcare-associated infections cause significant morbidity and mortality among hemodialysis (HD) patients. In HD centers, healthcare personnel (HCP) are required to have frequent contact with patients, equipment, and environmental surfaces, complicating infection-control measures. Characterizing HCP movement in relation to HD patients, other HCP, and the environment is critical to understanding pathogen transmission dynamics. The purpose of this project was to develop a system for measuring contact patterns within an outpatient HD center.

Methods: To measure HCP movement patterns we used custom-built, portable equipment composed of motes (credit-card-sized, programmable, battery-powered devices) including proximity motes, placed near each dialysis chair, and badge motes, given to all HCPs. In an 11 chair outpatient HD center, we used 30 proximity motes and 12 badge motes during two overlapping shifts. Motes were set to broadcast a brief message every 8 seconds. When received by other motes within range, we obtained the identifier of the mote that sent the message, signal strength, and time. By fusing these data, we estimated when and for how long HCPs were in close contact with other HCPs, HD equipment, and patient zones.

Results: Combining the messages sent and received by all of the motes, we estimated that each HCP had an average of 7.5 (sd 2.9) total close contacts per hour with a patient's chair: close is defined as close enough to touch the patient for at least 30 seconds. Each HCP had an average of 3.3 (sd 2.1) different close contacts with unique patients per hour. The average close contact lasted 58.1 seconds (sd 34.5), with a maximum of 4.27 (sd 1.0) minutes. Finally, clustering of HCPs also occasionally occurred with up to 3 HCPs in close contact with dialysis chairs at one time.

Conclusion: We developed a portable system for measuring contact patterns within HD settings. Unlike other automated electronic systems used to measure entry and exit within a multi-room environment, we were able to measure close contacts within a large single-room setting. Our results confirm that frequent interactions between HCPs and HD patients occur. The results of our system may help identify novel infection prevention strategies within outpatient HD centers.

1688. Extended Survival of Carbapenem-resistant Enterobacteriaceae (CRE) on Dry Surfaces

Part of Session: 191. Role of the Healthcare Environment in HAIs

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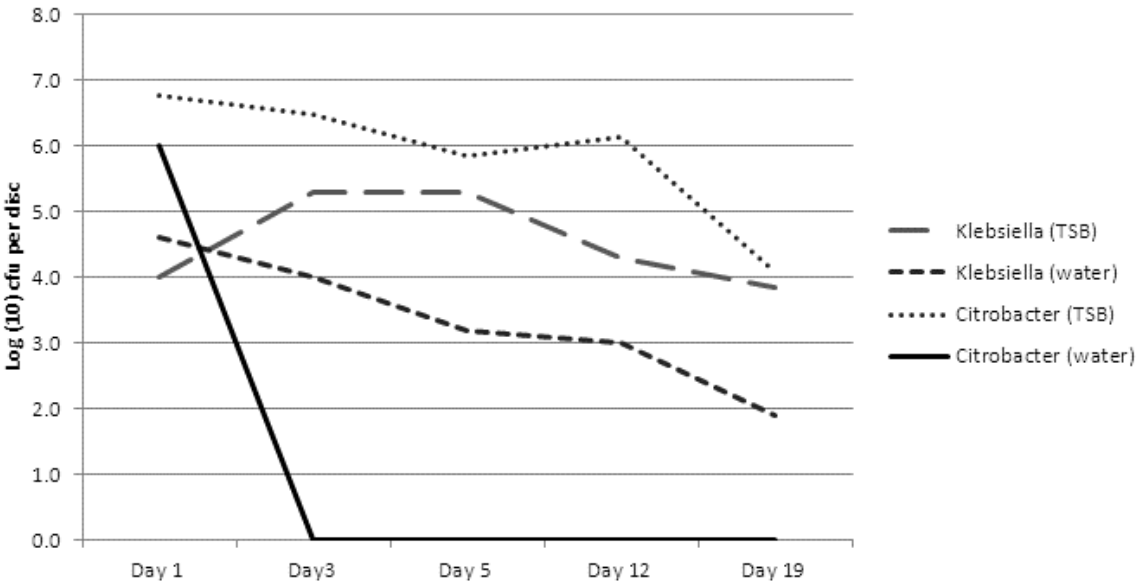
Background: Alarming increases in the prevalence of Carbapenam-resistant Enterobacteriacae(CRE) have been reported worldwide. With the limited treatment options and high rate of mortality, preventing the transmission of these organisms is of utmost importance. The role of the environment is recognized increasingly in the transmission of some hospital pathogens. We evaluated whether CRE are able to survive on dry surfaces for extended periods.

Methods: One strain of *Klebsiella pneumoniae* and one strain of *Citrobacter freundii* obtained from patients in our hospital in 2013 were grown overnight in trypticase soy broth (TSB). 20 µl of each overnight culture was inoculated onto discs. Additionally, the organisms were centrifuged and re-suspended in sterile water and inoculated on to stainless steel discs and allowed to dry overnight. The bacteria on the discs were eluted into 10 ml TSB and serially diluted, using sterile water and blood agar plates, to calculate the colony forming units (cfu) recovered from the discs. These dilutions were performed on days 1 (after overnight drying), 3, 5, 12, and 19.

Results: Both strains survived for at least 19 days. *K. pneumoniae* dried in both water and TSB survived for at least 19 days, with the *K. pneumoniae* dried in water generally yielding a lower cfu count. *C. freundii* dried in TSB survived for at least 19 days whereas *C. freundii* dried in water did not survive beyond overnight drying.



Conclusion: CRE can survive on inanimate surfaces for at least 19 days. The species and suspending medium appear to be a factors influencing the survival time on dry surfaces. The extended survival times identified in this study may be clinically relevant, allowing CRE to be transmitted from an environmental reservoir. Thorough cleaning of surfaces in patient rooms is needed to assure the removal of this organism to prevent nosocomial transmission in healthcare settings. Further studies involving survival of CRE on standard hospital surfaces appear warranted.

1689. Where do they hide and what is the impact on patient colonisation? Identification of environmental reservoirs of antimicrobial resistant bacteria in a general intensive care unit

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

The dynamics of the transmission of extended spectrum beta-lactamase producing Enterobacteriaceae (ESBL-E) and vancomycin resistant enterococci (VRE) in the general intensive care unit (ICU) are poorly understood. We screened environmental sites in the ICU seeking reservoirs of these bacteria and investigated their relationship to patient colonisation.

Methods:

Swabs were taken from six high-touch sites (patient monitor, patient infusion drip controls, bed control panel, patient mattress, chart holder and adjacent sink) adjacent to each patient, in a general ICU. Rectal swabs were used to screen patients. Swabs were enriched overnight in brain heart infusion broth at 37^{o}C and plated onto selective media-ESBL Brilliance for identification of ESBL-E and VRE select agar for identification of VRE after initial growth on UTI Brilliance. Identification of isolates was confirmed using MALDI-TOF.

Results:

In total, 503 sites adjacent to 47 patients were screened for ESBL-E and VRE. Of the sites tested, 43/503 (8.5%) were positive for VRE and of these 14/43(32.5%) were adjacent to a VRE-positive patient. Of the sites tested, 10/503(2%) were positive for ESBL-E. The commonest contaminated sites were the patient monitor and drip stand, representing 25/53 (47%) of positive sites. Of the 47 patients included in the study, 9/47(19%) were colonised with VRE, three of whom acquired VRE during the study period. One of these patients and their immediate environment became positive at the same time. Seven

(14%) patients were colonised with ESBL-E but these organisms were not detected in their environment. One patient was treated for an infection caused by multidrug resistant enterobacteriaceae and none of the patients were treated for VRE infection.

Conclusion:

Patient acquisition of VRE and environmental contamination may be closely linked in time. We have identified the patient monitor and drip stand as particular reservoirs for antimicrobial resistant organisms. The extent to which the environment, particularly equipment that represents a cleaning challenge, contributes to transmission of organisms requires further investigation, which may inform improved cleaning and infection prevention and control policies.

1690. Comparison of Methicillin-Resistant Staphylococcus aureus Contamination Rates of Medication Cabinets Between Isolation and Non-Isolation Rooms

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: High touch areas in hospitals may be contaminated with organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA). Patients who are in rooms that were previously occupied by a patient in isolation are at a higher risk for developing a hospital-acquired infection. Our institution transitioned from delivering medication to a centralized location on each nursing unit, to locked cabinets located directly outside of each patient's room. Observations of the new delivery and cleaning processes raised concerns for contamination of the medication cabinets and contents. The objective of this study was to determine if medication cabinets located outside of MRSA isolation rooms and their contents, particularly medication folders and unit dose medications, are at a higher risk of contamination with MRSA.

Methods: In this prospective matched cohort study, four areas of each medication cabinet were swabbed to identify contamination with microorganisms: cabinet keypad, underside of the handle, medication folder, and unit dose medication. Each MRSA isolation room was matched in a 1:1 fashion with a non-isolation room located on the same unit. Cultures from the swabs were identified by Gram stain, catalase activity, coagulase activity, and cefoxitin disc diffusion test.

Results: There were 653 samples collected from 176 rooms, 88 MRSA isolation rooms and 88 non-isolation rooms. Overall, 379/653 (58.1%) individual locations and 167/176 (94.9%) rooms were positive for bacterial contamination. *Staphylococcus aureus* was identified in 6/88 (6.8%) and 11/88 (12.5%) of the isolation and non-isolation rooms, respectively (P= 0.30), of which a single positive culture for MRSA was identified from each cohort. Gram-negative organisms were identified in 1/88 (1.1%) and 3/88 (3.4%) of the isolation and non-isolation rooms, respectively (P=0.62). Gram-positive catalase negative organisms were identified in 8/88 (9.1%) and 11/88 (12.5%) of the isolation and non-isolation rooms, respectively (P=0.62). Gram-positive coagulase negative organisms were identified in 80/88 (90.9%) and 79/88 (89.7%) of the isolation and non-isolation room respectively (P=1.0).

Conclusion: MRSA contamination was not significantly higher for medication cabinets located outside of MRSA isolation rooms compared to non-isolation rooms.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1691. Quantitative Assessment of Interactions between Hospitalized Patients and Portable Medical Equipment and Other Fomites

Part of Session: 191. Role of the Healthcare Environment in HAIs

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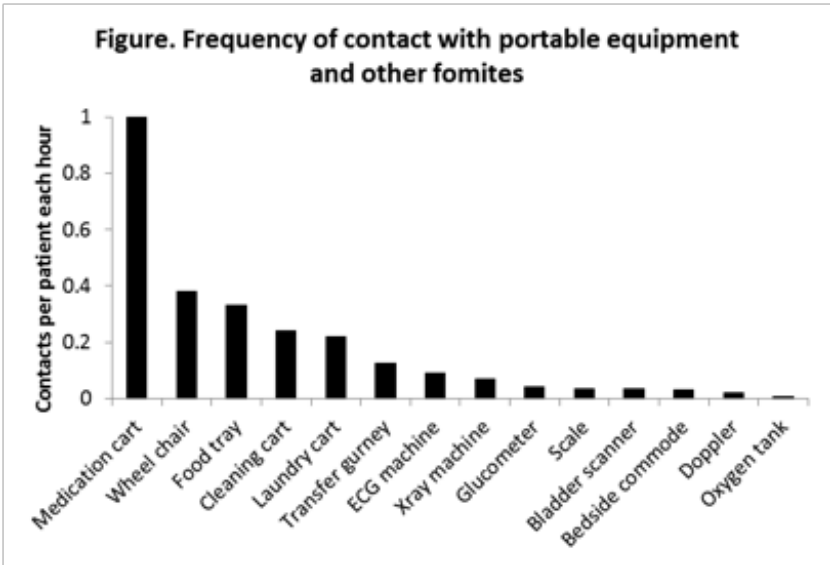
Background: Portable medical equipment and other fomites that are shared among patients are potential vectors for transmission of healthcare-associated pathogens. However, limited data are available on the frequency of and types of interactions between hospitalized patients and shared equipment and fomites.

Methods: During a 4-month period, a single observer quantified interactions of hospitalized patients on medical/surgical wards and in intensive care units with portable equipment and other fomites during routine hospital care. Interactions with patients required direct or indirect contact between the patient and/or surfaces in the room and the equipment or other fomite. The frequency of interactions between different types of fomites per room per hour was calculated. A point-prevalence culture survey was conducted to determine the frequency of contamination of the fomites with *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), and vancomycin-resistant *Enterococcus* (VRE).

Results: A total of 380 interactions were recorded during 144 room hours of observation (2.6 interactions per patient each hour), including 96 room hours on medical/surgical wards and 48 in intensive care units. The figure shows the frequencies of interaction with various types of equipment and fomites for medical/surgical wards and intensive care units. Of 80 cultures from equipment and fomites, 16 (20%) were contaminated with 1 or more of the healthcare-associated pathogens, with MRSA being cultured most frequently (10 of 80; 10%).

Conclusion: Hospitalized patients frequently had interactions with medical equipment and other fomites that are shared among patients and these items were often contaminated with healthcare-associated pathogens. There is a need for protocols to ensure routine cleaning and disinfection of portable medical equipment and other shared fomites.



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Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1692. Surface Microbiology of the iPad Tablet Computer and the Potential to Serve as a Fomite

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Previous work shows the presence of microorganisms on a variety of surfaces in healthcare settings. Recently, the use of tablet computers within the healthcare system has become commonplace; however there is a lack of study into this area. Here, we sought to elucidate the presence of microorganisms on iPads and categorize their potential as fomites.

Methods: Twenty one iPads uniformly distributed to pharmacy faculty practicing in a variety of settings were sampled. Neutraliser (polysorbate 80 30 g/L, Saponin 30 g/L, Lecithin 3 g/L, pH 7) was used as a sampling solution. Samples were collected using 5 flocked nylon swabs per iPad. Swab tips were immersed in neutraliser, vortexed, and plated on selective media to determine the quantities of select, clinically relevant pathogens. Samples were also inoculated into Mueller Hinton broth, incubated, and plated to determine presence of select pathogens below limits of quantification. Selective agars included Levine, MacConkey, cetrimide, mannitol salt, bile esculin azide, bile esculin azide with 6 mg/L vancomycin, and Chromagar MRSA II. Information relative to use and cleaning of each device was assessed via an electronic survey. Categorical and continuous data were compared by Fisher's exact and Student's *t* test, respectively.

Results: Devices were used in either inpatient (n = 11; 52%) or non-inpatient (outpatient or none [n = 10; 48%]) settings. There were no differences in frequency of use, cleaning habits, or device covers between groups, except there was more use within patient care areas in the inpatient group (72.7% vs. 20%; p = 0.03). More Gram positive organisms were recovered than Gram negative organisms overall. There were no differences between groups in terms of presence or mean quantities (Log CFU/mL) of organisms recovered. Drug-resistant organisms including methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus* spp., and *Pseudomonas aeruginosa* were recovered from 57%, 4.8%, and 4.8% of all iPads, respectively.

Conclusion: Gram positive and Gram negative organisms were recovered from the surfaces of iPads, including problematic multidrug-resistant pathogens. Healthcare providers should be aware of the potential of tablet computers to serve as a nidus for microorganism transmission.

1693. Use of Portable Electronic Devices in Hospitals : a Reservoir for Healthcare Pathogens

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

The electronic medical record has provided fertile ground for the expanded use of portable electronic devices in hospitals. Might these devices serve as fomites for the colonization and transmission of healthcare related pathogens?

Methods:

This multicenter project employed convenience sampling of mobile electronic devices (tablets (iPad®) and netbooks) used by physicians. Cultures of the screens and covers were obtained in a standardized fashion. Bacterial colonies were identified using standard biochemical analysis and by Matrix-Assisted Laser Desorption Ionization Time-of-Flight (MALDI-TOF). Anonymous questionnaires were completed from device users to collect demographic data, utilization, and hand and device hygiene information. Data were analyzed using chi-square and Student's t-test.

Results:

Two hundred and eight samples were obtained from 102 devices; 35% of devices were used by interns and 63% by males. Cultures revealed 128 non-pathogenic and 42 pathogenic isolates. All devices yielded at least one positive culture from the screen and/or cover.

Pathogens identified from Mobile Electronic Devices

	Screen Total = 102	Cover Total = 102	Total
Organism	%(n)	%(n)	%(n)
*S aureus**	10.7% (11)	12.7% (13)	11.8% (24)
MRSA	1.9% (2)	0.9% (1)	1.5% (3)
Pantoea spp	6.8% (7)	6.8% (7)	6.9% (14)
A baumannii	2.9% (3)	2.9% (3)	2.9% (6)
Enterobacter spp	0.9% (1)	0.9% (1)	1% (2)

Enterococcus spp	2.9% (3)	0.9% (1)	2% (4)
Rate of isolates/swab	27/102=0.264	26/102=0.254	53/204=0.259

*Includes MRSA

Two thirds of devices used on surgical services were colonized with pathogens compared with 17.3% used on non-surgical services (p=0.01). There was no association with frequency or type of device cleaning and colonization with pathogens. MALDI-TOF results were consistent with standard microbiologic culturing techniques 97% of the time.

Conclusion:

Colonization of mobile electronic devices healthcare pathogens occurs on both medical and surgical services providing potential reservoirs for pathogen growth and spread. The relationship between contamination and device cleaning is unclear. Further research is needed to determine the risk for spread of pathogens from devices to patients and what methods of cleaning and/or policies are necessary to allow for the safe use of portable devices in hospitals.

1694. A novel agent to decrease contamination on hospital scrubs

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Up to 40% of healthcare-associated infections (HAI) can be attributed to cross contamination from healthcare workers (HCW) contaminated with bacteria during patient care. The purpose of this study was to assess the efficacy of a novel antimicrobial treatment of hospital scrubs, Chitosan/DMDM Hydantoin (Sanogiene; BioMed Protect, Earth City, MO), in decreasing bacterial contamination.

Methods: This study was a double blind randomized crossover trial in which HCWs were enrolled from ICUs at the University of Maryland Medical Center. Each participant was given 4 identical sets of scrubs (2 treated and 2 untreated sets) and was provided a schedule of wear. Eight unannounced sampling sessions were randomly selected over a 2-month period; each scrub set was sampled twice and samples were collected at the end of a shift. A pre-moistened sterile swab was rubbed over the front of the scrubs and a rodac agar plate stamped directly on the scrub top near the belly button. Swabs were evaluated for the presence of *Staphylococcus aureus*, *Enterococcus* spp., and pathogenic Gram-negative bacteria; total aerobic colony forming units (CFU) were recorded from the rodac agar plates after 48 hrs of incubation. Outcomes were compared and risk factors for scrub contamination were assessed using GEE.

Results: 110 HCWs were enrolled, 90 completed and were analyzed in the study. A total of 720 samples were collected (90 x 8 samples each). Overall, 30% (217/720) of scrubs were contaminated with pathogenic bacteria; 30.0% (108/360) of treated scrubs and 30.3% (109/360) of non-treated (p=.94). Risk factors for identification of pathogenic bacteria from scrubs were caring for a patient with wounds (OR 1.77, 95% CI 1.18 to 2.66) and bathing a patient (OR 1.50, 95% CI 1.00 to 2.27). The average CFU was 49 for treated and 52 for non-treated scrubs (p=.51). Bathing a patient was associated with increased CFU (ln CFU) of scrubs (+0.24, 95%CI 0.026 to 0.44); caring for patients on contact precautions was associated with decreased CFU (-0.24, 95%CI -0.41 to -0.06).

Conclusion: Antimicrobial coating of scrubs was not effective in preventing bacterial contamination. Before hospitals or healthcare workers invest in antimicrobial scrubs, more research is necessary to determine the optimal mode of prevention for HCW attire contamination.

1695. Universal Gowning and Gloving Reduces Health Care Worker Clothing Contamination

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Healthcare worker (HCW) clothing becomes contaminated with bacteria during usual patient care. We performed this study to determine if gowning and gloving for all patient care activities reduces contamination of HCW clothing, compared to standard practice.

Methods: Study sites were recruited from medical or surgical ICUs randomized to the intervention arm of the Benefits of Universal Gown and Glove (BUGG) study, and 5 sites participated in this sub-study. Cross-sectional surveys were performed twice: once during the BUGG intervention period (July-Sept 2012), using gowns/gloves on room entry for all patients; and again after the intervention ended (Oct – Dec 2012), when standard care (SC) had resumed (gowns/gloves only for patients in contact isolation). During each phase HCW clothing was sampled both at the beginning and end of their shift using pre-moistened swabs. HCWs were surveyed regarding profession and specific duties (such as bathing patients) during their shift. Cultures were performed using broth enrichment followed by selective media. Acquisition was defined as having a negative culture or non-pathogenic growth at the beginning of shift, and pathogen growth at the end of shift.

Results: A total of 348 HCWs participated over 5 sites (21-92 per site), including 179 (51%) during the BUGG intervention phase. The majority (73%) were nurses. Pathogens were identified on HCW clothing in 88 (25%) at the beginning of their shift. Overall, 51 (15%) HCWs acquired pathogenic bacteria on their clothing by the end of their shift; 13 (7.1%) HCWs acquired during the BUGG phase compared to 38 (23%) HCWs during the SC phase (OR 0.27, 95%CI 0.13-0.53, p <0.001). Pathogens identified included enterococci (25, including 1 VRE), *Staphylococcus aureus* (25, including 7 MRSA), *Pseudomonas* (4), *Acinetobacter* (4), and *Klebsiella* (2) species. Job type and specific job duties were not associated with acquisition.

Conclusion: Using standard care nearly one quarter of HCWs contaminate their clothing during their shift; this was reduced by 70% by gowning and gloving for all patient interactions. HCW clothing contamination may be one mechanism by which pathogens are transferred between patients, and suggests that gowns provide additional benefit to gloves when used universally.

1696. Are you wearing your gown correctly? An assessment of proper gowning when entering a contact isolation room

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

Contact precautions, with donning of gown and gloves, is associated with a 60% reduction in methicillin-resistant *Staphylococcus aureus* (MRSA) acquisition. Studies have also shown that multidrug resistant organisms (MDRO) can contaminate healthcare workers' gowns and gloves after 5 minutes in the patient room emphasizing the need to not only wear gowns, but to wear gowns correctly. We assessed the compliance with the donning of gowns correctly prior to entering a room in contact isolation.

Methods:

A cross-sectional observational study was performed at a public safety net hospital. Using a standard form, infection preventionists noted the following information for healthcare workers entering a contact isolation room: healthcare personnel type, location (floor, unit type, emergency department) and method of wearing the gown. The definition of compliance was wearing the gown tied at both the top and bottom.

Results:

Of 113 observations, only 21.2% (n = 24) healthcare workers correctly donned the gown when entering a contact isolation room. The 89 non-compliant healthcare workers wore the gown in a variety of fashions including tied at the top only (13.3%, n = 15), tied at the bottom only (30.1%, n = 34), not tied at all (16.8%, n = 18) and backwards (1.8%, n = 2). Nineteen (16.8% healthcare workers did not wear a gown at all when entering the room. The improper gown use was observed in every type of patient care area that was studied: 100% (n = 6) in the Emergency Department; 73.7% (n = 19) in the intensive care units; and 76.1% (n = 88) in the acute care units. Proper gown use was highest among the 15 custodians observed (25%) and lowest among the 17 observed physicians (4.5%).

Conclusion:

The dismal rate of proper gown use is of major concern. Evidence supports the donning of gowns when entering rooms of

patients infected with a MDRO prevents spread amongst patients. Studies that assess efficacy of gown and glove use for control of MDROs need to incorporate evaluations of compliance with proper donning of the gowns.

1697. The Case for Standard Precautions

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Contact isolation is used in most acute care settings for patients who are colonized and infected with multi-drug resistant organisms (MDROs). Gowns and gloves are worn for all patient contact in order to contain MDROs and decrease transmission. Yet contact isolation can have a negative effect on a patient's overall outcomes causing decreased patient satisfaction and less quality interactions with health care workers (HCWs). The Infection Prevention Committee at Saint John's Health Center (SJHC) determined that the negative outcomes of contact isolation far outweigh the benefits. As a result, the team embarked upon new contact isolation practices for the hospital. Practices were adapted so that only patients with active, difficult to contain infections or significant pathogens were placed in contact isolation.

Methods: Starting in 2002, patients with colonization were no longer placed in contact isolation. Contact isolation was instead focused on patients with active infections including: C. diff., infected wounds, lice, scabies, and herpes lesions, as well as significant pathogens such as MDR Acinetobacter and Carbapenem-Resistant Enterobacteriaceae. HCWs were trained to use standard precautions and good hand hygiene for all patient interactions.

Results: From 2002 to 2011, hospital acquired infections (HAIs) decreased. During this time, decreases occurred housewide in CL-BSI with 22 cases in 2002 (a rate of 1.99) to 5 cases in 2011 (0.64); CA-UTI with 110 cases in 2002 (5.34) to 5 cases in 2011 (0.30); MRSA with 89 cases in 2002 (1.23) to 7 cases in 2011 (0.13); VRE with 26 cases in 2002 (0.36) to 0 cases in 2011; and C.diff. with 42 cases in 2002 (0.58) to 19 cases in 2011 (0.35). This data illustrates that a correlation between staff education, changes in isolation practices, and decreases in HAIs can be made.

Conclusion: The approach at SJHC is not new. Body substance isolation was used in acute care settings in the 1980's to protect HCWs from body fluids. SJHC has initiated a similar practice by shifting focus to good, common sense care for all patients. This experience illustrates that contact isolation is not necessary for patients colonized with MDRO's when standard precautions and good hand hygiene are the focus.

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1698. Environmental cleaning practices – results of environmental services (EVS) management survey

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

Studies have confirmed that patients placed in rooms previously occupied by persons colonized or infected with multidrug-resistant organisms have a 73% increased risk of acquiring the same pathogen. To help reduce this risk, the CDC has established guidelines for environmental cleaning, which specify the types of disinfectants and indications for use. However there is less guidance regarding several aspects of cleaning including types of cleaning clothes used and work flow.

Methods:

In order to better understand EVS practices, we developed a 10 item web-linked survey to gather cross-sectional data on

basic environmental cleaning practices. The survey was disturbed to EVS managers working at 5 different hospitals of a large health care system in a large metropolitan area in Midwestern USA. A response rate of 100% was achieved.

Results: The majority (70%) of the respondents were male and 73% were older than 40 years of age. Typical duration of room cleaning (both daily and terminal) was up to 30 minutes (quoted time by 96% of responders for daily cleaning; and 76.9% of responders for terminal cleaning). We did not find any differences in the duration of daily cleaning of “contact isolation rooms” versus non-contact isolation rooms, however the duration of time spent in terminal cleaning of contact isolation rooms was longer (73.1% allocated 30-60 minutes vs under 30 minutes). Cotton wipes were cited as being used for cleaning in all location, usually (61.5%) in conjunction with a bucket of disinfectant (typically quaternary ammonium compounds). Microfiber wipes, dry and wet disposable wipes were rarely used. Frequency of changing the disinfectant in the bucket varied from never in a single day to changing it for each room cleaned. All respondents reported using the “mop and bucket method to clean floors.

Conclusion:

This study elucidated typical cleaning practices and protocols at an urban multi-center health care system. Although cleaning was reported to be thorough and practices consistent, we found variability in cleaning methods and styles. We need to further ascertain cleaning related knowledge, attitudes and practices of both managers and personnel. There is also a need to study appropriate duration and types of materials required for effective room cleaning.

1699. Outbreak Investigation into an Increased Incidence of Non-tuberculous Mycobacterium in Sputum Cultures in Pediatric Blood and Marrow Transplant Patients

Part of Session: 191. Role of the Healthcare Environment in HAIs

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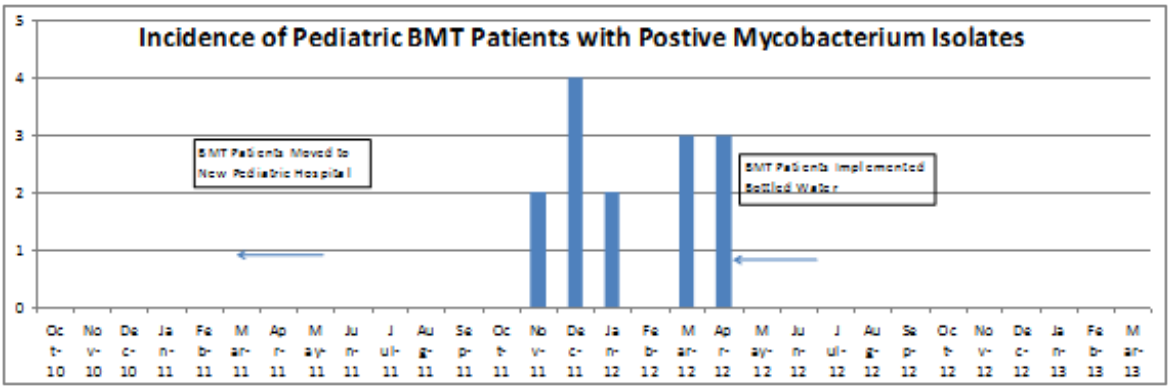
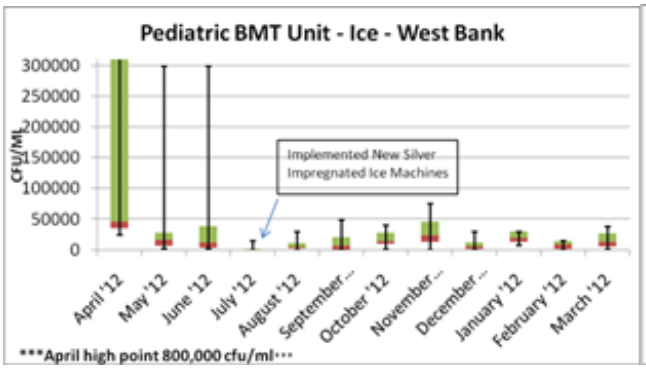
Background: Nov. 2011-Apr. 2012 we noted an increased incidence in non-tuberculous rapidly growing mycobacteria (NTM) in sputum cultures from pediatric patients undergoing blood and marrow transplantation (BMT), with 14 pediatric (Peds) BMT patients with NTM isolates over this period, compared with 0 the year before. This occurred within one year of moving to a newly constructed hospital. We focused our investigation on water sources.

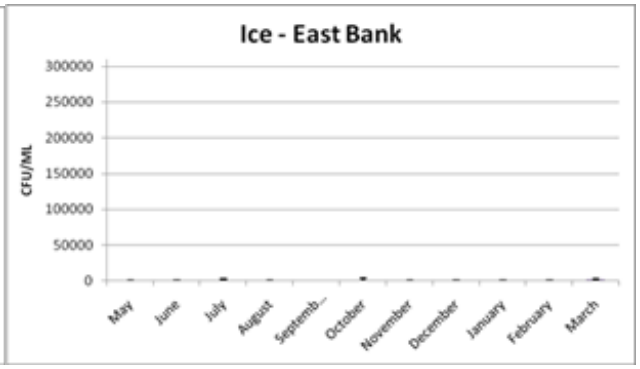
Methods: Samples were obtained from the water entering the hospital, pipes leading to the Peds BMT unit, tap water, shower water, drinking water and ice machines on the new unit, and from the old hospital's BMT ward. Total bacterial colony forming units (cfu)/ml of water were counted. Select isolates were identified as rapidly growing mycobacteria that matched patient NTM species.

Results: Intensive testing of water and ice from the drinking water and ice machines over the past year has shown a distinct difference in cfu/ml drinking water between the old and new hospital buildings. The old hospital shows bacterial counts between 0 and 5000 cfu/ml in the water and 0 and 4000 cfu/ml in the ice. The new hospital BMT unit's water pre-interventions (new silver ice machines, filters, pipe flushing, etc.) was as high as 300,000 cfu/ml in water and 800,000 cfu/ml in ice. Post-interventions, counts in drinking water ranged from 0 to 115,000 cfu/ml and ice from 0 to 75,000 cfu/ml, not consistently meeting the levels we had in the old hospital. We banned drinking water and ice on the new unit except for bottled water and there have been no more isolates of NTM from the Peds BMT patients in one year.

Conclusion: Levels of bacteria in the water in the ice and drinking water machines on the new Peds BMT unit was not safe for consumption by the BMT population. The level of cfu/ml water in the old hospital was safe based on historical experience. We have undertaken several measures to try to lower the bacterial cfu/ml in the drinking water and ice on the new Peds BMT unit and have had significant decreases, but have not consistently achieved the levels seen on the older hospital's unit, with the same type of drinking water and ice machines. It was determined that water and ice levels of 4,000 cfu/ml would be our target to allow patients to use the drinking water and ice on the new unit.







Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1700. Occurrence of MRSA, Enteric and Spore forming Bacteria on Fomites in Hospital Cafeterias: Impact of Hydrogen Peroxide Wipes

Part of Session: 191. Role of the Healthcare Environment in HAIs

CHARLES GERBA, PH.D. and SHERI MAXWELL, BS; University of Arizona, Tucson, AZ

Background: Hospital cafeterias have been overlooked as potential sites that may harbor bacteria involved in nosocomial infections. Both medical staff and patients use these facilities on an almost continuous basis in large medical centers. The goal of this study was to document the occurrence and concentration of bacteria in a large hospital cafeteria and assess the use of disposable hydrogen peroxide cleaner disinfectant wipes on bacterial numbers

Methods: A total of forty samples were collected. The same exact sites in the cafeteria were later sampled after disinfecting with disposable hydrogen peroxide cleaner disinfectant wipes. Approximately four square inches of each site was swabbed using a sterile Sponge-Stick containing Letheen neutralizing broth. Samples were tested for total and aerobic spore forming bacteria, coliform bacteria, *Escherichia coli* and methicillin resistant *Staphylococcus aureus* (MRSA).

Results: The greatest concentrations of bacteria were found on the cafeteria table tops. MRSA was isolated from two of the six push button soda pop dispensers (33%). Coliforms were detected on all of the sampled surfaces with numbers often exceeding 2,400 CFU/4 inches square. *E. coli* was detected on 71% of the table tops, but not on any other location. Aerobic spore formers were detected on 51% of all surfaces tested. The use of disposable hydrogen peroxide cleaner disinfectant wipes reduced the levels of all groups of organisms below detection limits. The results suggest that cafeterias could harbor bacteria involved in nosocomial infections within health care facilities.

Conclusion: : Food surface areas are usually disinfected with only cotton towels soaked in quaternary ammonium disinfectants or bleach. However, it has been shown that cloth towels react to reduce the effective concentration of these disinfectants. Coliform bacteria, *E. coli* and other enteric bacteria have been shown to occur in disinfectant soaked cleaning towels in restaurants and actually spread these bacteria when the cleaning towels are used. Use of disposable hydrogen peroxide cleaner disinfectant wipes was shown to reduce all types of vegetative and aerobic spore forming bacteria below detection limits on common high touch cafeteria surfaces.

1701. Comparing Cleaning and Disinfection using the Traditional Cloth and Bucket Method versus the Ready to Use Wipe Method: Process Compliance and Time-Related Costs

Part of Session: 191. Role of the Healthcare Environment in HAIs

TIMOTHY L. WIEMKEN, PHD, MPH, CIC[1], EMILY PACHOLSKI, MPHC[1], ROBERT KELLEY, PHD[1], JUANITA CLAY, MSN, RN[2], KIMBERLY DANIELS, RN[2], MICHAEL BROMILOW[2] and JULIO RAMIREZ, MD[1]; [1]University of Louisville, Louisville, KY, [2]Kindred Healthcare, Louisville, KY

Background:

Cleaning and disinfection (CD) are critical interventions for the reduction of healthcare-associated infections. One major challenge of the CD process is ensuring that the product is applied to surfaces in compliance with local policies and procedures. The traditional “cloth and bucket method” has been associated with lack of process compliance. New products such as ready to use (RTU) CD wipes have not been evaluated regarding process compliance or ease of use compared to traditional methods. The objective of this study was to evaluate the process compliance and the cost effectiveness of RTU wipe method versus the bucket method.

Methods:

This was an unblinded randomized study. Employees with environmental services responsibilities were invited to participate. Participants were randomized to disinfect six pre-specified areas in a patient room with either the RTU wipe method or the traditional cloth and bucket method. Upon completion, the employee repeated the disinfection with the other method. All areas were marked with an invisible fluorescent marker before each task. Process compliance was measured on a 3 point scale: 0 points for a complete miss of the area, 1 point for a partial miss (smeared but still visible), and 2 points for completely removing the fluorescent marker, for a maximum of 12 points for all six tasks. Time-related cost savings were calculated using the time to complete each task, the average employee workload, and the employee hourly wage.

Results:

Nine employees participated in the study. Process compliance significantly increased for the RTU wipe method versus the cloth and bucket method (92% versus 67%, P=0.017). There was a significant decrease in the time to complete all six tasks using the RTU wipes versus the bucket method (3 minutes versus 4 minutes, P=0.003). This translated to a time-related cost savings of $38.58 (95% CI $34.07-$41.08) per employee per day.

Conclusion:

The RTU wipe method significantly increased CD process compliance and resulted in less personnel time to complete the same tasks compared with the cloth and bucket method. Introducing an RTU wipe method procedure will increase process compliance and may result in decreased transmission of nosocomial pathogens.

Findings in the abstracts are embargoed until 12:01 a.m. PST, Oct. 17th with the exception of research findings presented at the **ID**Week press conferences.

1702. Evaluation of a Soft Surface Sanitizer in Healthcare Environments

Part of Session: 191. Role of the Healthcare Environment in HAIs

KELLY REYNOLDS, PHD; University of Arizona, Tucson, AZ and JONATHAN SEXTON, PHD; The University of Arizona, Tucson, AZ

Background: Environmental controls of microbial contaminants in healthcare settings have primarily focused on disinfecting hard, non-porous surfaces. Soft surfaces are also subject to microbial contamination and likely contribute to nosocomial disease transmission but are often overlooked in infection control protocols. Effective interventions are needed to minimize exposures to soft surface contaminants and reduce patient and worker infection risks. The purpose of this study was to determine the efficacy of a soft surface sanitizer (Citrace®, Clorox Healthcare™) intervention in healthcare environments. **Methods:** Samples were collected from three different healthcare settings: an intermediate, long-term care facility, a general physician’s outpatient clinic, and a college campus health outpatient clinic. Each location was visited twice with a minimum of a week in-between visits. Soft surfaces targeted for swabbing included waiting room chairs, patient room chairs and privacy curtains. Background microbial populations were first quantitated followed by pre- and post-intervention sampling. Eluted swabs were assayed for HPC bacteria, *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Escherichia coli*. Method recovery efficiency was calculated via seeding of *S. aureus* onto simulated fabric chair surfaces following a 5 minute drying cycle. **Results:** *Staphylococcus* species were identified in 11% (7/62) of the

background samples with a waiting room chair testing positive for MRSA. The waiting room chairs had the highest concentration of HPC bacteria before the intervention ($9.4 \times 10^2 + 2.9 \times 10^3$ cfu/in^2) and the privacy curtains had the lowest ($2.6 \times 10^2 + 5.4 \times 10^2$ cfu/in^2). HPC bacterial concentration on patient room chairs were $4.5 \times 10^2 + 5.1 \times 10^2$ cfu/in^2. Application of the intervention in the healthcare environment resulted in microbial reductions of 98.5%, 97.7% and 95.0% on the waiting room chairs, patient room chairs and privacy curtains, respectively. **Conclusion:** The soft surface treatment intervention was effective at reducing the concentration of HPC bacteria by up to 98.5%. Routine application contributes to the overall reduction of microbes in indoor environments and is expected to reduce microbial exposures and infection risks in healthcare environments.

1703. Comparing the Clinical Effectiveness of Surface Disinfectants

Part of Session: 191. Role of the Healthcare Environment in HAIs

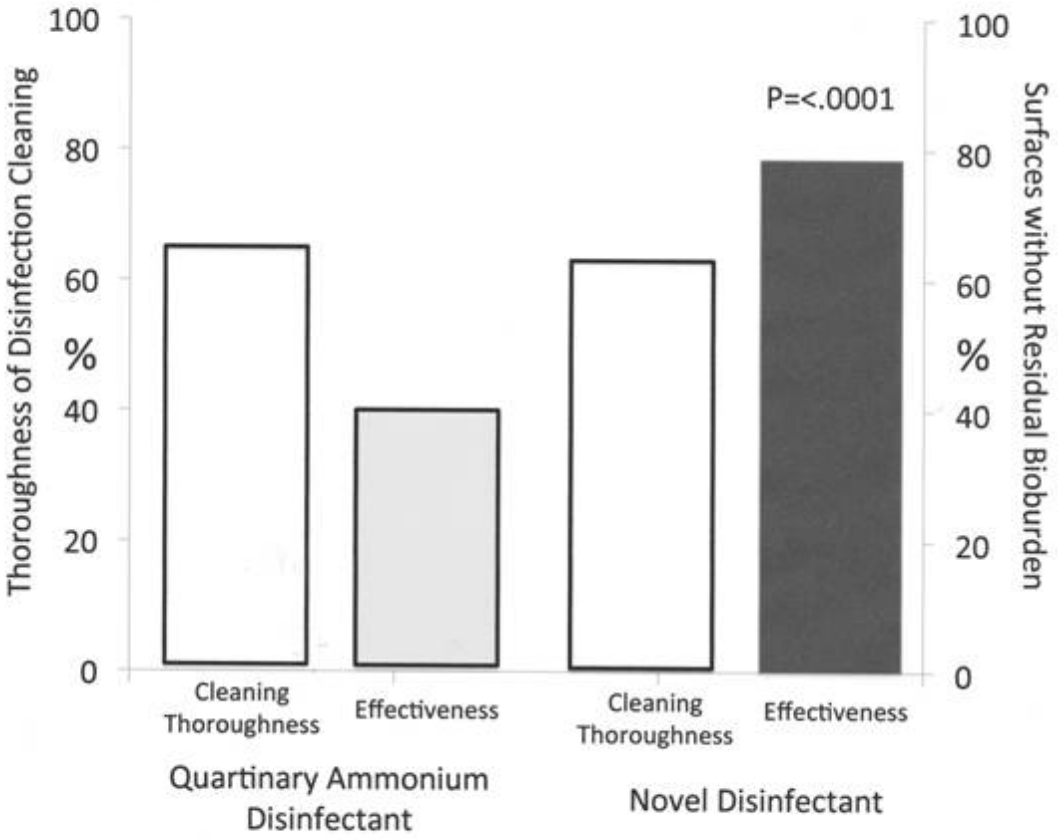
PHILIP C. CARLING, MD, FSHEA; Boston University School of Medicine, Boston, MA, JOANN FERGUSON, RN, BAN; Norh Memorial Medical Center/Maple Grove Hospital, Maple Grove, MN, ANITA THOMASSER, BS; Ecolab, Eagan, MN and JENNIFER PERKINS, BS MBA; Maple Grove Hospital, Maple Grove, MN

Background: While disinfectant cleaning of near-patient surface has been an accepted healthcare standard for decades, the relative efficacy of disinfectant chemistries has not been studied in clinical use.

Methods: An EPA-registered quaternary ammonium disinfectant (QAC) and a novel EPA-registered sporicidal disinfectant (ND) with peracetic acid/hydrogen peroxide as the active ingredients were evaluated on a 48 bed clinical care unit as part of routine discharge cleaning. Twelve high touch surfaces recommended by the CDC toolkit Options for Evaluating Environmental Cleaning were evaluated. Prior to cleaning each surface was dip slide cultured and marked with a fluorescent marker (DAZO™). After the room was discharge cleaned each surface was again cultured and the presence or removal of the fluorescent marker noted. Surfaces without detectable aerobic bacteria prior to cleaning were eliminated from analysis. Following cleaning, only surfaces with complete removal of the fluorescent mark and no detectable bacterial burden (0 CFU) were defined as effectively cleaned.

Results: A total of 571 surfaces were evaluated before and after cleaning. During the QAC phase, 93 of 237 (40%) of evaluable surfaces showed complete removal of bacterial burden and during the ND phase of the study, 211 of 274 (77%) of evaluable surfaces showed complete removal of bacterial burden while 66.4% and 65.3%, respectively, of surfaces were cleaned as evidenced by fluorescent marker removal ($p = .8$). (Figure) In the context of the study design, the ND was 1.93 times more effective at reducing bioburden on high touch objects than the QAC ($p < .0001$).

Conclusion: This study found that there was relatively greater reduction in environmental bacterial burden associated with the use of the ND, however, further evaluation in different settings is warranted. In addition, we believe that this study design defines a method to evaluate the relative clinical efficacy of disinfectant formulations as well as other materials and technologies used in environmental hygiene in order to objectively evaluate best practices for decreasing the risk of pathogen transmission from contaminated surfaces to patients through the use of various cleaning modalities and chemistries.



1704. How clean is clean?

Part of Session: 191. Role of the Healthcare Environment in HAIs

MOI LIN LING, MBBS, FRCPA, CPHQ, MBA, KWEE YUEN TAN, BSC and AMANDA PANG; Singapore General Hospital, Singapore, Singapore

Background: Contaminated environmental surfaces serve as potential reservoir for transmission of pathogens through direct and indirect contact. Effective environmental cleaning plays a critical role in the prevention of healthcare associated infections. This study aims to evaluate environmental cleaning with quaternary ammonium compound (QUAT) and sodium hypochlorite wipes.

Methods: This study was done at two Orthopaedic wards of a 1600-bedded acute tertiary care hospital in Singapore from June 2011 to February 2013, with each ward receiving routine clean with QUAT or SANI-CLOTH® Bleach Germicidal Disposable Wipes (1:10 dilution of sodium hypochlorite) in cross-over design. Fourteen high-touch sites were screened weekly using a fluorescent targeting method (Glo-Germ) to assess thoroughness of cleaning. Five high-touch surfaces (bed rails, bed side table, call box, chair and cardiac table) in 60 patient zones were sampled for bacteria after cleaning following a patient's discharge from the ward.

Results:

The Glo-Germ screen showed an aggregate cleanliness of 86.1% when cleaned with QUAT and 85.8% with SANI-CLOTH (Chi square, $p = 0.94$). The median value for cleanliness was 85.2% for QUAT and 87.3% for SANI-CLOTH. Of the 316 sites tested for bacterial growth following cleaning with QUAT, 96.5% of sites had positive bacterial cultures before cleaning and 83.9% post-cleaning ($p<0.01$). Cleaning with SANI-CLOTH wipes yielded a significant reduction in sites tested positive for bacteria post-cleaning from 91.5% to 44.9% ($p<0.01$).

Conclusion:

Our experience demonstrates that a marker for microbiological clean is more sensitive than that of a fluorescent targeting method in the assessment for thoroughness of cleaning. Secondly, the use of bleach wipes yielded a more effective clean compared to the routine use of QUAT. More study is needed to determine whether the uses of bleach wipes have any significant impact on patient colonization or infection.

1705. Re-Assessing the Relationship Between Aerobic Colony Counts (ACC) and Adenosine Triphosphate (ATP) Bioluminescence Assays When Sampling Environmental Surfaces in Hospital Settings

Part of Session: 191. Role of the Healthcare Environment in HAIs

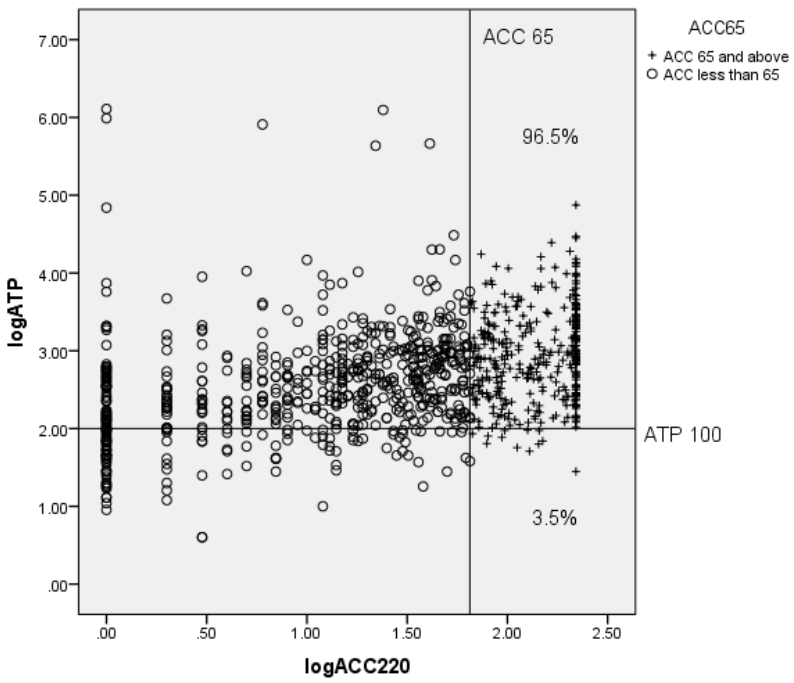
JOHN M. BOYCE, MD, FIDSA, NANCY L. HAVILL, MT(ASCP), CIC and RENEE FEKIETA, PHD; Yale-New Haven Hospital, New Haven, CT

Background: **Methods** for monitoring the adequacy of cleaning and disinfection of environmental surfaces in hospitals include use of fluorescent markers, ACC and ATP bioluminescence. Because the correlation between ACC and ATP in previous studies has been low or insignificant, some have questioned the utility of ATP assays for monitoring cleaning practices.

Methods: In a previous study (ICHE 2011;32:1187), 5 high-touch surfaces in 100 hospital rooms were sampled before and after cleaning using D/E agar contact plates and an ATP assay (Clean-Trace, 3M) (total - 1000 sampling episodes). The areas sampled by the ATP assay (~ 4 sq in.) were the same size as those sampled by agar contact plates. For the present analysis, continuous ACC and ATP readings were converted to Log_{10} values, and analyzed using Pearson correlation coefficients. Scatter plots were overlaid with two different ACC cutoff points for defining cleanliness (ACC < 2.5 CFU/cm^2 and < 0.4 CFU/cm^2), and varying ATP cutoffs.

Results: There was a low, albeit significant correlation between ACC and ATP ($r = 0.386$, $p < 0.001$). If only the 500 sets of readings obtained after cleaning were included, the level of correlation was lower, but still significant ($r = 0.32$, $p < .001$). A scatter plot revealed that only 3.5% of surfaces classified as dirty by ACC (> 2.5 CFU/cm^2) had an ATP value of < 100 relative light units (RLU). If cleanliness was defined as an ACC < 0.4 CFU/cm^2, only 6.8% of surfaces classified as dirty by ACC (> 0.4 CFU/cm2) had an ATP value < 100 RLU.

Scatterplot of ATP & ACC (max 220) log values (Before & After included)



Conclusion: In this study, expressing ACC and ATP readings as $\log_{10}$ values resulted in low, but significant levels of correlation between ACC and ATP results. The findings suggest that re-assessing the ATP and ACC breakpoints used to define surfaces as clean may provide users with a greater level of confidence that surfaces with low ATP levels will also have low levels of contamination by aerobic bacteria. Additional studies comparing these monitoring procedures under varying conditions are needed.

1706. Ultraviolet Light for Terminal Disinfection of Neonatal Incubators

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: Neonatal incubators are challenging to clean thoroughly. We performed a validation study to determine whether ultraviolet light (UV-C), used in addition to manufacturer-recommended manual cleaning, reduced bacterial contamination of neonatal incubators.

Methods: After neonates were discharged or transferred, their incubators were held for the study. We sampled 20 incubators at 3 separate times: prior to manual cleaning; after manual cleaning; and after UV-C disinfection (EDU, Lumalier). Four standardized high touch surfaces were selected for each sample. Aides cleaning the incubators were blinded to the locations being sampled. Each site was sampled using a pre-moistened swab, and cultures were performed using broth enrichment followed by selective media to isolate Gram-positive and Gram-negative organisms.

Results: Of 80 sites (4 x 20 incubators), bacterial growth was found in 62 (77.5%) sites prior to manual cleaning, 40 (50.0%) sites after manual cleaning (36% relative reduction), and 12 (15.0%) sites after UV-C (70% relative reduction compared manual cleaning, $p < 0.001$). The most common single organism was coagulase-negative *Staphylococci*

(CoNS). Excluding CoNS and common skin flora, 29 (36.3%) had pathogens identified before manual cleaning, with a mean of 1.3 pathogens (range, 1-3) among those with any pathogenic growth. This decreased to 3 pathogens (methicillin-resistant *S. aureus*, *Acinetobacter* and *Enterococcus* species) after manual cleaning (3.8% of sites), a 90% relative reduction, and to 1 pathogen (*Enterococcus*) after UV-C (1.3% of sites), a 67% relative reduction compared to manual cleaning alone (p = 0.6). The UV-C disinfection added approximately 1 hour to the terminal cleaning process.

Conclusion: This small validation study demonstrated that using UV-C for terminal disinfection further reduced bacterial growth on newborn incubators compared to manual cleaning alone, which may reduce the risk of acquisition for the next neonate. The inability of UV-C to penetrate the incubators' clear acrylic material required a lengthy process with multiple cycles to disinfect both sides. Formal cost-effectiveness analysis is needed. The importance of effective manual cleaning as a first step should not be overlooked.

1707. Hydrogen peroxide vapor (HPV) room disinfection significantly reduces the rate of C. Difficile infection

Part of Session: 191. Role of the Healthcare Environment in HAIs

KIMBERLY HORN, RN, BS, MPH, CIC; Flagstaff Medical Center, Flagstaff, AZ

Hydrogen peroxide vapor (HPV) room disinfection significantly reduces the rate of *C. difficile* infection

Kim Horn, Diana Rolland

Flagstaff Medical Center, Flagstaff, Arizona

Background: *Clostridum difficile* is an important cause of antibiotic-associated diarrhea in hospitalized patients. *C. difficile* infection (CDI) is an important cause of morbidity and mortality, particularly in older patients. During episodes of diarrhea, *C. difficile* spores are shed into the environment and can survival for extended periods of time. Admission to a room previously occupied by a patient with *C. difficile* increases the chances of acquisition CDI.

Methods: Hydrogen peroxide vapor (HPV) room disinfection was implemented across the hospital for the terminal room disinfection upon discharge of patients with CDI starting in October 2011. The percentage of rooms receiving terminal disinfection with (HPV) upon discharge was calculated from January to September 2011. The rate of CDI was compared for the 12 months prior to the implementation of HPV with the 12 months after HPV. The monthly handwashing rate was determined by handwashing observations with 30 observations per unit.

Results: The mean monthly CDI rate fell from 1.3 per 1000 patient days in the 12 months prior to HPV to 0.7 in the first 12 months of HPV use (p<0.001.) 89% of 152 CDI discharges were disinfected using HPV. Compliance with hand hygiene increased from 78% to 85% comparing the same periods; this difference was not statistically significant (p=0.21).

Conclusion: We showed that the terminal room disinfection with HPV of patients discharged with CDI was associated with a significant reduction in the rate of CDI acquisition. We also identified a non-significant increase in hand hygiene in the same period, which could confound the apparent association. Rooms vacated by patients with CDI were prioritized for HPV, meaning that only a small number were missed. Hospitals should consider the use of HPV to augment terminal disinfection of rooms vacated by patients with CDI.

1708. Inter-hospital Variation in Time Required for Hospital Room Ultraviolet (UV)-C Irradiation: Preliminary Experience from the Benefits of Enhanced Terminal Room (BETR) Disinfection Study

Part of Session: 191. Role of the Healthcare Environment in HAIs

DEVERICK J. ANDERSON, MD, MPH[1], WILLIAM RUTALA, PHD, FSHEA[2], LAUREN KNELSON, MSPH[1], REBEKAH W. MOEHRING, MD, MPH[1], LUKE F. CHEN, MBBS, MPH, CIC, FRACP[1], DAVID J. WEBER, MD, MPH, FIDSA, FSHEA[2], DANIEL J. SEXTON, MD, FIDSA[1] and THE CDC PREVENTION EPICENTERS PROGRAM; [1]Duke University Medical Center, Durham, NC, [2]University of North Carolina Health Care, Chapel Hill, NC

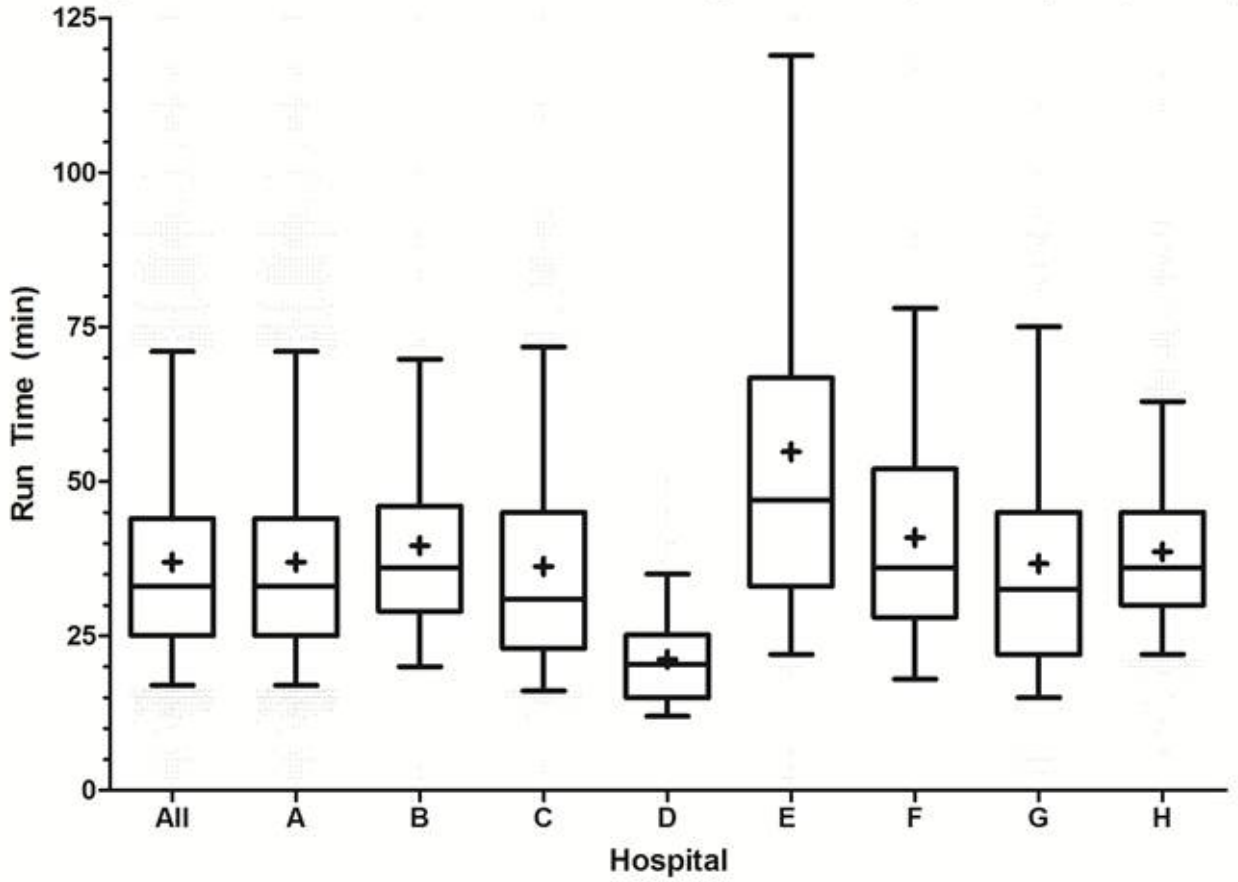
Background: "No touch" room decontamination techniques such as UV-C irradiation are used increasingly to improve the effectiveness of room cleaning but pose implementation challenges. We herein describe preliminary experience from the use of UV-C emitting devices in an ongoing multicenter interventional study.

Methods: Eight hospitals used 1-4 automated UV-C emitting devices (Tru-D SmartUVCÔ; Lumalier Corporation) from 5/1/12-4/1/13. Trained environmental services (EVS) personnel at each hospital followed specific protocols to operate the UV-C devices. One of two UV-C dose cycles was used: 12,000 µWs/cm^2 for vegetative bacteria or 22,000 µWs/cm^2 for spores. Automated UV-C devices measured the delivered doses of UV-irradiation before automatically turning off. EVS personnel recorded irradiation run times and whether or not the cycle was interrupted. Differences in run times across hospitals were compared using factorial ANOVA.

Results: A total of 9,935 rooms were irradiated using the UV-C emitting devices during the 11-month study period. The median run time per room was 33 minutes (IQR 25-44). Run times varied significantly among study hospitals ($p<0.001$, Figure 1). 7,709 (78%) rooms were irradiated using the vegetative bacteria cycle; 1,309 (13%) rooms were irradiated using the spore cycle. Cycle type was not recorded for 917 (9%) rooms. The median run time for the vegetative bacteria cycle was 31 minutes (IQR 24.5-41). The median time for the spore cycle was 52 minutes (IQR 39-66). Run times varied significantly among study hospitals for both vegetative ($p<0.001$) and spore cycles ($p<0.001$).

Conclusion: The cycle time to complete UV-C decontamination varied between hospitals. Time variation was likely related to differences in the amount and type of materials in rooms and room design, layout, and size. These data illustrate that UV-C emitters without built-in programs to measure the total dose of irradiation may either under or overestimate the time necessary to adequately disinfect patient rooms.

Figure 1. Run Times for an automated UV-C emitting device in 8 hospitals - all cycles (n=9,935)



1709. Efficacy of Commercially Available Antimicrobial Copper Surfaces Against Common Nosocomial Pathogens

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

The demand for novel approaches for prevention of hospital-associated infections (HAIs) has recently focused on intrinsically antimicrobial surfaces such as copper. We assessed the bactericidal activity for common nosocomial pathogens of various copper surfaces over time in comparison to stainless steel.

Methods:

Methicillin-susceptible *Staphylococcus aureus* (MSSA, ATCC 29213) and clinical isolates of Vancomycin-resistant *Enterococcus faecium* and *Acinetobacter baumannii* were evaluated. Products tested included 80% copper (Cu)/20% nickel (Ni) alloy; 90% Cu/10% Ni; 100% Cu; and antimicrobial Copper products from LuminOre Inc. (64 % Cu , 11% Ni, 20% Other ingredients) and EoS protective surface from Cupron(16% Cu(i) Oxide/ 84% Other ingredients. Stainless steel was the negative control.

Organisms grown on sheep blood agar (BAP) were suspended in saline and standardized to a density approximating 1.5 x 10^8 CFU/mL. A 10 uL aliquot was applied to 4 separate cleaned and sterilized coupons (1 cm^2) which were incubated at room temperature for either 0, 30, 60 or 120 minutes. After incubation, the coupon was placed in 1 mL D/E buffer containing glass beads and vortexed. An aliquot was removed, serially diluted and plated onto BAPs in duplicate to determine surviving CFU per coupon. At least 4 replicates of each coupon were tested.

Ranking of products was performed by fitting exponential decay models to the CFU/coupon and ranking kill rates. Statistical differences between kill rates were determined by two-tailed z-tests on kill rates.

Results:

For all three organisms, all copper surfaces demonstrated statistically significant enhanced killing compared with stainless steel, although there were differences between organisms and surfaces. For MSSA, LuminOre Copper-colored pebbled surface killed best (p=0.035 compared with next highest ranked sample); for VRE, LuminOre Nickel-colored smooth (p=0.01); for *Acinetobacter*, all Copper materials were comparable (p=0.006 compared with stainless steel).

Conclusion:

All copper products demonstrated significantly enhanced killing compared with stainless steel, with two LuminOre products showing greatest efficacy for MSSA and VRE.

1710. Environmental Contamination by Patients Infected or Colonized with MRSA or VRE: A multicenter study

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background: It is unknown whether the degree of environmental contamination differs between patients who are infected or simply colonized with methicillin-resistant Staphylococcus aureus (MRSA) or vancomycin-resistant Enterococcus (VRE). In this multicenter study, we examined the difference in hospital room contamination between patients infected and colonized with MRSA or VRE.

Methods: A convenience sample of 49 rooms of patients infected or colonized with MRSA or VRE (target organisms) at Duke University Medical Center (n=8) and the University of North Carolina Health Care (n=41) were tested from 7/21/2009

to 2/29/2012. 5 to 10 high-touch surfaces were sampled after patient discharge but prior to terminal room cleaning. Total colony forming units (CFUs) of MRSA or VRE per room and per surface were calculated. Standard descriptive statistics were used; median differences in room contamination of target organisms between infected and colonized patients were compared using Wilcoxon rank-sum tests.

Results: 33 (67%) patients were colonized with either MRSA or VRE, 15 (31%) patients had infections, and 1 infection status was unknown. 19 (39%) patients were colonized or infected with MRSA and 30 (61%) patients were colonized or infected with VRE. 43 (88%) patients had 1 anatomic site of colonization/infection; 5 (10%) had 2 sites. 1073 total environmental cultures were taken from 27 floor and 22 ICU rooms. Infected patients stayed in the room longer (median 16.4 days, IQR 4-20) than colonized patients (median 7.0 days, IQR 4-16; p=0.28), yet the median total target CFUs per room was higher for colonized patients (25, IQR 0-106) than infected patients (0, IQR 0-29; p-value=0.03); 24 (73%) colonized rooms had >=1 environmental site positive for MRSA or VRE compared with 5 (33%) infected rooms (p<0.001). There were no significant differences in median CFUs when data were analyzed by organism type, by number of anatomic sites colonized/infected, by room type, or by locations that were sampled within rooms.

Conclusion: To our surprise, environmental contamination with MRSA or VRE was as high or higher in rooms with colonization as in rooms with infection. Adequate cleaning techniques are needed to prevent bacteria from contaminating room surfaces in patients that are colonized or infected with organisms like MRSA and VRE.

1711. How do you bed bathe your patients? The variations in bed bathing methods among healthcare personnel

Part of Session: 191. Role of the Healthcare Environment in HAIs

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Background:

Chlorhexidine gluconate (CHG) bed baths are associated with reductions in healthcare-associated infections (HAI) specifically *Clostridium difficile* and central line-associated bloodstream infections (CLABSI). The methods utilized to bed bathe patients were not fully understood in our 477 licensed bed Level I trauma hospital. Our objective was to characterize the technique of bed bathing so that we may target areas of misconceptions and efficiently implement a uniform bed bathing protocol.

Methods:

A survey of bed bathing practices was developed and distributed through Survey Monkey. The survey addressed questions such as use, dilution, rinsing and drying of CHG; bath frequency; and double dipping wash cloths. The type of healthcare personnel and years of healthcare experience were collected. The Cochran-Mantel-Haenszel test was used to determine associations between practices, personnel type and number of years of experience. The survey was sent to all registered nurses (RN), healthcare technicians, certified nurse assistants, and licensed nurse practitioners caring for inpatients.

Results:

The survey was administered to 811 employees; 160 (20.5%) completed the survey. Ninety-two employees (57.5%) bathe patients with soap and 74 (46.3%) with CHG. Of the 74 that use CHG, dilutions ranged from none to >1:100 and 26 (37.1%) were not aware of the dilution they used. There was variability in the frequency of bed baths with reports of twice daily (1.9%, n = 3), daily (51.8%, n = 83), every other day (31.3%, n = 50) and weekly (15%). RNs were more likely ($p < 0.001$) to double dip the wash cloths in the basin compared to other healthcare personnel. Healthcare workers that have < 5 years experience were significantly more likely ($p = 0.04$) to not rinse the CHG at the end of the bath.

Conclusion:

Significant bed bathing variations exist amongst healthcare personnel, which likely occur in many hospitals and suggest the need for national standards. Our intervention will focus on a uniform protocol using a single dilution of CHG along with elimination of double dipping wash cloths and bathing with regular frequency. Elimination of the bed bathing variation will benefit staff efficiency and prevent HAI in our patients.