

**IIR 09-099**

**Improving Practice: Automated Compliance  
Monitoring in Infection Control**

Eli N. Perencevich MD MS, Principal Investigator  
Iowa City VA Health Care System, Iowa City, IA  
Funding Period: January 2011 - December 2013

**BACKGROUND/RATIONALE:**

The VA MRSA Initiative's potential to reduce MRSA infections will only be realized if healthcare workers are compliant with hand hygiene and contact precautions (wearing gown and glove by healthcare workers each time they enter a patient's room). Thus, if healthcare workers do not wash their hands and wear gloves/gowns when they see patients, the very expensive MRSA Initiative may be ineffective. Two factors are known to improve compliance with infection control practice: 1) Continuous monitoring of compliance and 2) Direct feedback of compliance rates to healthcare workers with a goal to get compliance up to 100%. However, direct observation of hand hygiene and glove wearing is labor intensive, expensive and rarely occurs during night shifts. Additionally, isolated patients may be subject to better or poorer hand hygiene compliance.

**OBJECTIVE(S):**

The objectives of this study are: (1) Measure, using direct observations, monthly compliance with hand-hygiene, glove use and gown use and correlate this measure with compliance as estimated through monthly supply-chain delivery of gowns, gloves and bottles of alcohol-based hand rub at an intensive care unit and hospital ward level. (2) Complete both a cross-sectional study and a case-crossover study to assess risk-factors (e.g. nursing-staff workload, time of day) for poor compliance with hand-hygiene, gown and glove use. Measure and compare the independent associations of these risk-factors with directly observed compliance with hand-hygiene and contact precautions (gown and glove use). (3) Provide sustained feedback of estimated compliance calculated through the use of automated monthly supply delivery counts of alcohol-based hand rub, gowns and gloves to specific hospital wards and statistically link estimated improved compliance with actual directly observed compliance using an upper-level quasi-experimental design with cross-over and non-equivalent control groups within 5 ICUs and 6 wards at 3 VA acute care hospitals. Additionally, we seek to determine if contact isolation modifies or improves healthcare worker behavior including hand hygiene.

**METHODS:**

This proposal contains two distinct studies. The first study will develop and validate supply chain delivery of alcohol-based hand rub and glove use as a viable estimate of the related actual infection control compliance measure will utilize an observational cohort study, while controlling for potential confounders. The second study will test the efficacy of sustained feedback of automated

monthly supply delivery counts of alcohol-based hand rub and gloves in improving compliance and reducing MRSA infections in 6 hospital intensive care units in 3 VA acute care hospitals using an interrupted time-series analysis quasi-experimental design with non-equivalent control groups.

### **FINDINGS/RESULTS:**

We have completed two reports. The first was accepted for publication 11/20/2012 and will be published in January 2013. (Morgan DJ et al. Infect Control Hosp Epidemiol 2013 Jan;34(1):69-73). In this report, observers performed "secret shopper" monitoring of healthcare worker activities during routine care, using a standardized collection tool and fixed 1-hour observation periods. A total of 7,743 patient visits by the healthcare worker were observed over 1,989 hours. Patients isolated had 36.4% fewer hourly HCW visits than patients not on contact precautions (2.78 vs 4.37 visits per hour); as well as 17.7% less direct patient contact time with HCWs (13.98 vs 16.98 minutes per hour) Patients on contact precautions tended to have fewer visitors (23.6% fewer). Healthcare workers were more likely to perform hand hygiene on exiting the room of a patient on contact precautions (63.2% vs 47.4% in rooms of patients not on contact precautions; Thus, independent of the direct effect of contact isolation, isolation was also associated with activities likely to reduce transmission of resistant pathogens, such as fewer visits and better hand hygiene at exit, while exposing patients on contact precautions to less HCW contact, less visitor contact, and potentially other unintended outcomes. The second report presented at the 2013 IDWeek National Meeting in San Diego, Reisinger et al. described the results of a clinical trial of point-of-use reminder signs for improving hand hygiene compliance. In Feb 2012 one of 4 signs were placed next to hand rub dispensers on 5 randomly chosen VA wards and ICUs. The remaining 6 control wards/ICUs did not have signs 13,221 hand hygiene opportunities were observed pre-intervention and 915 opportunities were observed in the intervention period. The sign with patient-focused and gain-framed language had the highest entry compliance 53% vs 29% for the other signs (p=0.042) and the highest exit compliance 79% vs 52% for the other signs (p=0.36).

### **IMPACT:**

The Anticipated Impacts on Veteran's Healthcare: Methicillin-resistant Staphylococcus aureus (MRSA) is an antibiotic-resistant bacterium that is associated with 94,000 invasive infections and 18,000 deaths annually in the United States. Since March 15, 2007 a National VA MRSA Initiative (VHA Directive 2007-002) has required all VA hospitals to screen for and isolate patients colonized with MRSA by placing them on contact precautions. The Initiative's aim is to reduce MRSA infections and related mortality by preventing MRSA from spreading from patient-to-patient in VA hospitals. This project seeks to improve the effectiveness of the MRSA Initiative by improving healthcare worker compliance with infection control best practice (hand washing and wearing gloves/gowns) and thus reduce the spread of MRSA in VA Hospitals.

## PUBLICATIONS:

### Journal Articles

- Day HR, Perencevich EN, Harris AD, Gruber-Baldini AL, Himelhoch SS, Brown CH, Morgan DJ. Depression, Anxiety, and Moods of Hospitalized Patients under Contact Precautions. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. 2013 Mar 1; 34:(3):251-8.
- Quezada Joaquin NM, Diekema DJ, Perencevich EN, Bailey G, Winokur PL, Schweizer ML. Long-Term Risk for Readmission, Methicillin-Resistant Staphylococcus aureus (MRSA) Infection, and Death among MRSA-Colonized Veterans. *Antimicrobial agents and chemotherapy*. 2013 Mar 1; 57(3):1169-72.
- Kumar G, Falk DM, Bonello RS, Kahn JM, Perencevich E, Cram P. The costs of critical care telemedicine programs: a systematic review and analysis. *Chest*. 2013 Jan 1; 143:(1):19-29.
- Morgan DJ, Pineles L, Shardell M, Graham MM, Mohammadi S, Forrest GN, Reisinger HS, Schweizer ML, Perencevich EN. The effect of contact precautions on healthcare worker activity in acute care hospitals. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. 2013 Jan 1; 34(1):69-73.
- Ohl M, Lund B, Belperio PS, Goetz MB, Rimland D, Richardson K, Justice A, Perencevich E, Vaughan-Sarrazin M. Rural residence and adoption of a novel HIV therapy in a national, equal-access healthcare system. *AIDS and behavior*. 2013 Jan 1; 17:(1):250-9.
- Huttner B, Robicsek AA, Gervaz P, Perencevich EN, Schiffer E, Schrenzel J, Harbarth S. Epidemiology of Methicillin-Resistant Staphylococcus aureus Carriage and MRSA Surgical Site Infections in Patients Undergoing Colorectal Surgery: A Cohort Study in Two Centers. *Surgical Infections*. 2012 Dec 16; 13(6):401-5.
- Morgan DJ, Pineles L, Shardell M, Young A, Ellingson K, Jernigan JA, Day HR, Thom KA, Harris AD, Perencevich EN. Automated hand hygiene count devices may better measure compliance than human observation. *American journal of infection control*. 2012 Dec 1; 40:(10):955-9.
- Leekha S, Diekema DJ, Perencevich EN. Seasonality of staphylococcal infections. *Clinical Microbiology and Infection : The Official Publication of The European Society of Clinical Microbiology and Infectious Diseases*. 2012 Oct 1; 18:(10):927-33.
- Thom KA, Maragakis LL, Richards K, Johnson JK, Roup B, Lawson P, Harris AD, Fuss EP, Pass MA, Blythe D, Perencevich EN, Wilson L, Maryland MDRO Prevention Collaborative. Assessing the burden of *Acinetobacter baumannii* in Maryland: a statewide cross-sectional period

prevalence survey. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. 2012 Sep 1; 33(9):883-8.

- Morgan DJ, Rogawski E, Thom KA, Johnson JK, Perencevich EN, Shardell M, Leekha S, Harris AD. Transfer of multidrug-resistant bacteria to healthcare workers' gloves and gowns after patient contact increases with environmental contamination. *Critical care medicine*. 2012 Apr 1; 40(4):1045-51.
- Standiford HC, Chan S, Tripoli M, Weekes E, Forrest GN. Antimicrobial stewardship at a large tertiary care academic medical center: cost analysis before, during, and after a 7-year program. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. 2012 Apr 1; 33(4):338-45.
- Logan JL, Yang J, Forrest G. Outpatient antibiotic prescribing in a low-risk veteran population with acute respiratory symptoms. *Hospital practice (1995)*. 2012 Feb 1; 40(1):75-80.
- Kwon S, Schweizer ML, Perencevich EN. National Institute of Allergy and Infectious Disease (NIAID) Funding for Studies of Hospital-Associated Bacterial Pathogens: Are Funds Proportionate to Burden of Disease?. *Antimicrobial resistance and infection control*. 2012 Jan 26; 1:(1):5.
- Carnahan RM, Moores KG, Perencevich EN. A systematic review of validated methods for identifying infection related to blood products, tissue grafts, or organ transplants using administrative data. *Pharmacoepidemiology and drug safety*. 2012 Jan 1; 21 Suppl 1:213-21.
- Morgan DJ, Day HR, Harris AD, Furuno JP, Perencevich EN. The impact of Contact Isolation on the quality of inpatient hospital care. *PLoS ONE*. 2011 Dec 5; 6(7):e22190.
- Forrest GN, Arnold RS, Gammie JS, Gilliam BL. Single center experience of a vancomycin resistant enterococcal endocarditis cohort. *The Journal of Infection*. 2011 Dec 1; 63(6):420-8.
- Furuno JP, Johnson JK, Schweizer ML, Uche A, Stine OC, Shurland SM, Forrest GN. Community-associated methicillin-resistant *Staphylococcus aureus* bacteremia and endocarditis among HIV patients: a cohort study. *BMC infectious diseases*. 2011 Oct 31; 11:298.
- Fitzgibbons LN, Puls DL, Mackay K, Forrest GN. Management of gram-positive coccal bacteremia and hemodialysis. *American journal of kidney diseases : the official journal of the National Kidney Foundation*. 2011 Apr 1; 57(4):624-40.
- Morgan DJ, Day HR, Furuno JP, Young A, Johnson JK, Bradham DD, Perencevich EN. Improving efficiency in active surveillance for methicillin-resistant *Staphylococcus aureus* or vancomycin-resistant *Enterococcus* at hospital admission. *Infection control and hospital epidemiology : the official journal of the Society of Hospital*

Epidemiologists of America. 2010 Dec 1; 31(12):1230-5.

- Perencevich EN, Treise DM. Methicillin-resistant Staphylococcus aureus and the media. Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America. 2010 Nov 1; 31 Suppl 1:S48-50.

#### Book Chapters

- Forrest GN. Controversies in Antimicrobial Stewardship. In: Safdar A, editor. Principles and Practice of Cancer Infectious Diseases (Current Clinical Oncology). New York: Humana Press; 2011. Chapter 44. 499-506 p.

#### Conference Presentations

- Perencevich EN. Hand Hygiene Challenges in CLC Settings. Paper presented at: VA Community Living Center One Health Annual Conference; 2012 Sep 5; Cincinnati, OH.
- Perencevich EN. Role of Environmental Contamination in Patient-to-Patient Transmission via the Healthcare Worker. Paper presented at: Association for Professionals in Infection Control and Epidemiology Annual Conference; 2012 Jun 4; San Antonio, TX.
- Perencevich EN. The Changing Face of Transmission Prevention. Paper presented at: VA National Infectious Diseases Service Annual Conference; 2012 May 14; Dallas, TX.
- Forrest GN. Early Diagnosis of Surgical Infection: Rapid Microbiological Diagnostics. Paper presented at: American College of Surgeons National Surgical Quality Improvement Program Annual Meeting; 2011 Oct 23; San Francisco, CA.
- Bhalla P, Forrest GN, Chen J, La Russa P, Steinberg S, Gershon A. Disseminated Varicella Infection Due to Oka -Vaccine (vOka) Strain of Varicella-Zoster Virus (VZV) in an Adult. Presented at: Infectious Diseases Society of America Annual Meeting; 2011 Oct 21; Boston, MA.
- Gleitsmann K, Forrest GN, Humphries L, Austin D, James K. Antibiotic Overprescribing for Acute Respiratory Illness in the Portland VA Outpatient Clinics. Presented at: Infectious Diseases Society of America Annual Meeting; 2011 Oct 21; Boston, MA.
- Perencevich EN. Infection Control Bundles: Where Do We Go from Here? Paper presented at: Interscience Conference on Antimicrobial Agents and Chemotherapy; 2011 Sep 19; Chicago, IL.
- Perencevich EN. Novel Infection Prevention Epidemiological Study Designs. Paper presented at: Interscience Conference on Antimicrobial Agents and Chemotherapy; 2011 Sep 18; Chicago, IL.
- Perencevich EN. Epidemiological Rationale for Regional Approaches to MRSA Control. Paper presented at: International Conference on Prevention and Infection Control; 2011 Jul 1; Geneva, Switzerland.

- Perencevich EN. Seasonal and Weather-mediated Variations in Hospital Pathogen: Opportunities for Prevention. Paper presented at: International Conference on Prevention and Infection Control; 2011 Jul 1; Geneva, Switzerland.
- Perencevich EN. Exploration of Risk-Factors and Control of Resistant Bacterial Pathogens in the Hospital Setting. Paper presented at: Creighton University School of Medicine Infectious Disease Annual Symposium; 2011 Apr 29; Omaha, NE.
- Perencevich EN. Reducing CLABSI through Blood, Sweat and Tears with a Happy Ending. Paper presented at: Association for Professionals in Infection Control and Epidemiology Illinois Conference; 2010 Nov 5; Springfield, IL.

#### Journal Other

- Ajao AO, Harris AD, Johnson JK, Roghmann MC, Perencevich EN, Schweizer ML, Zhan M, Chen WH, Furuno JP. Association between methicillin-resistant Staphylococcus aureus colonization and infection may not differ by age group. [Editorial]. *Infection control and hospital epidemiology : the official journal of the Society of Hospital Epidemiologists of America*. 2013 Jan 1; 34(1):93-5.
- Perencevich EN. Deconstructing the Veterans Affairs MRSA prevention bundle. [Editorial]. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*. 2012 Jun 1; 54(11):1621-3.
- Perencevich EN, Lautenbach E. Infection prevention and comparative effectiveness research. [Editorial]. *JAMA : the journal of the American Medical Association*. 2011 Apr 13; 305(14):1482-3.

#### Center Product

- Perencevich EN, Reisinger HS. Hand Hygiene: State of the Art. National Teleconference for the VA Infection: Don't Pass it On Campaign. [Cyberseminar]. 2012 Feb 23.

This research is supported by the Department of Veteran Affairs, Veterans Health Administration, Office of Research and Development, Health Services Research and Development Award IIR 09-099