Healthcare-Associated Infection Prevention and Antibiotic Stewardship across Care Transitions

Nimalie D. Stone, MD/MS
Ambulatory and Long Term Care Team
Division of Healthcare Quality Promotion

Indiana Healthcare Leadership Conference

October 27, 2011

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

Presentation Outline

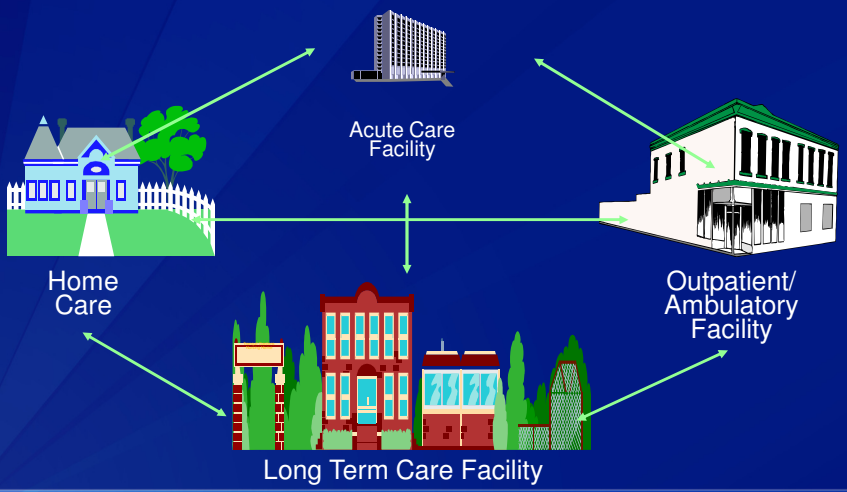
- Describe the changing healthcare delivery system and the increased focus on healthcare-associated infection prevention
- Discuss a few mechanisms by which antibiotic resistance emerges in healthcare
- Discuss antibiotic stewardship and inter-facility communication as strategies for improving infection prevention efforts during care transitions

The Changing Spectrum of Healthcare

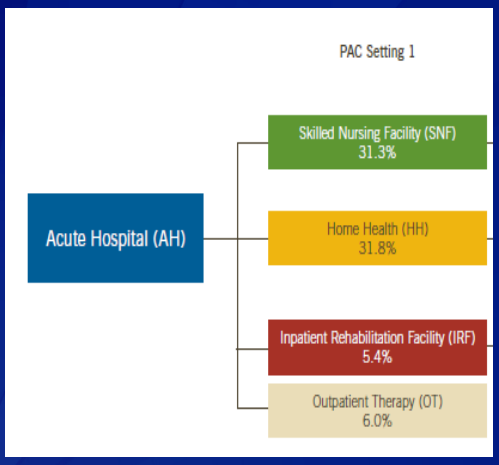
National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

CDC

Healthcare Delivery Expanding Beyond Acute Care Hospitals



Skilled Nursing and Home Health Account for 60% of Post-Acute Care

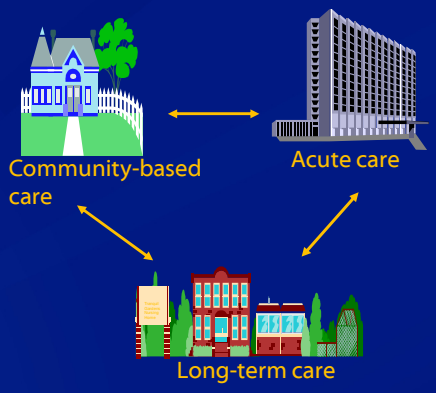


- In 2006, average length of stay in acute care hospitals was 4.8 days
  - Decreased from 6.4 in 1990 (25%)
  - For people >65, decreased from 8.7 to 5.5 days (37%)

Research Triangle Institute. (2009). *Examining Post Acute Care Relationships in An Integrated Hospital System. Waltham, MA;* Buie VC, et al. National Hospital Discharge Survey: 2006 summary. National Center for Health Statistics. Vital Health Stat 13(168). 2010

Growing Complexity in the Post-Acute Care Populations

- Growing medical complexity and care needs
- Increasing exposure to devices, wounds and antibiotics
- High prevalence of multidrug-resistant organisms
- Dynamic movement across settings



Impacts where healthcare-associated infections manifest

The Diverse Spectrum of Healthcare

"Post-acute care"

- Long-term acute care hospitals (LTACH)
- Rehabilitation facilities
- Skilled nursing facilities (SNF)
- Hospice / Home health

Long-term care

- Nursing homes (NH) / SNF
- Assisted Living Facilities
- Residential care facilities
- Home-based care / Senior day care services

Ambulatory care

Growth of the Long-term Acute Care Hospital Population

- Acute care hospital intensive/critical care units are the primary source of new admissions

From 1997 to 2006

- Overall number of Medicare admissions to acute care hospital ICUs fell 14%
- However, the number of Medicare ICU patients discharged to LTACHs almost tripled.
  - Critical care hospitalizations resulting in transfer to an LTACH climbed from 0.7% to 2.5%
- Patients transferred to LTACH had shorter acute care LOS than similar patients not sent to a LTACH

Kahn JM et al. *JAMA. 2010;303(22):2253-2259*
Medicare Payment Advisory Commission. Report to the Congress: Medicare payment policy. Long-term care hospital services: Ch. 10 **March 2011.**

Changing Population in Skilled Nursing Facilities/ Nursing Homes

- 3.2 million residents received care in 15,956 certified SNF/NH in the US in 2008
  - Acute care hospitals are the primary source of new admissions
- From 1999 to 2008
  - 16% decrease in the number of nursing home beds/ 1000 residents of US population;
  - 10% increase in the number of residents cared for in LTC
  - Increasing proportion of individuals under the age of 65 are receiving care in LTCFs (13.6% in 2008)
  - Growing post-acute care population as custodial care shifts to assisted-living

Nursing Home Compendium 2009, CMS

Expansion of Assisted Living Facilities

- Group living arrangement, in home-like environment
- 2004: 975,000 beds (>2x growth since 1990s)
  - Estimated 2X growth to ~2 million residents by 2030
- Provide residents help with activities of daily living, medication administration
  - e.g., Assisted Monitoring of Blood Glucose
- Care primarily provided by non-professional staff, limited on-site staff with clinical expertise or training
  - Resources for infection control are lacking
- No current federal regulatory oversight
  - Licensing, inspection at state level highly variable

Assisted Living State Regulatory Review 2010: www.ahcancal.org

Growth in Ambulatory Care Settings: Two Examples

- Hemodialysis
  - 2008: 354,600 maintenance hemodialysis patients in the U.S.[1]
  - 2008: 5240 (82% increase since 1996)
- Ambulatory Surgical Centers
  - 2009: 5175 (240% increase since 1996)
  - Outpatient procedures represent ¾ of all U.S. surgical operations , large proportion occurring in ASCs[2]
    - In 2007, approximately 6 million procedures were performed in ASCs[3]
  - Wide-variety of procedures including: endoscopy, orthopedic surgery, plastic surgery, podiatry[3]

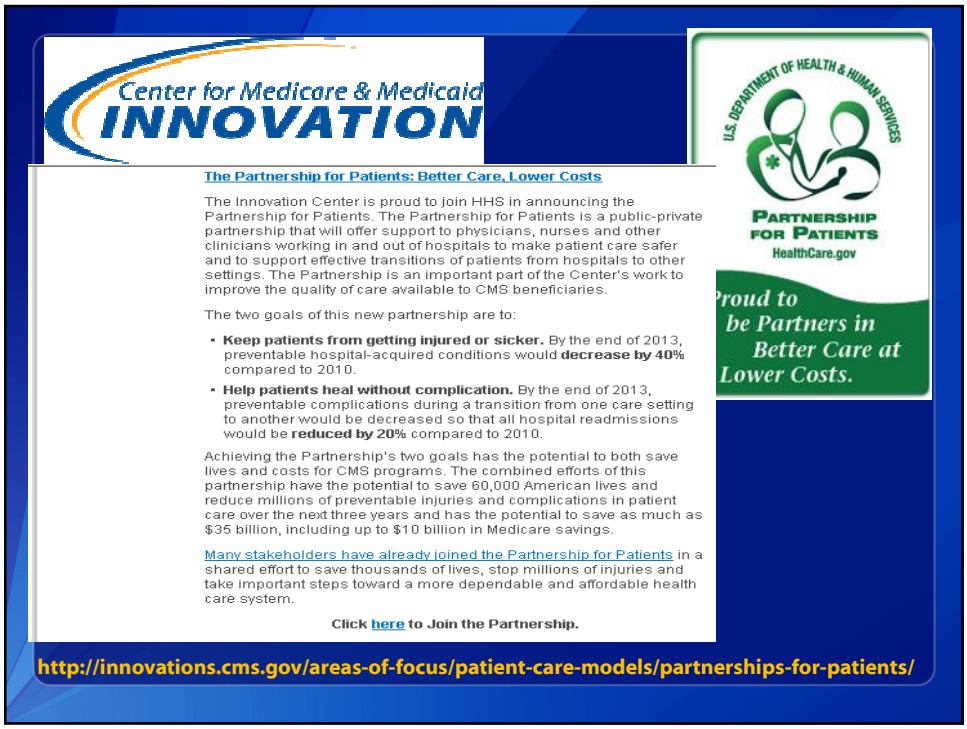
1.2010 USRDS Annual Data Report. Available at: http://www.usrds.org/adr.htm
2.Barie PS. Infection Control Practices in Ambulatory Surgical Centers. JAMA. 2010;303:2295-7
3.Schaefer MK et al. JAMA 2010;303 (22):2273-79

Healthcare-Associated Infection Burden across Healthcare

- Acute care (1.7 million HAIs each year)
  - Affects 1 out of 20 patients
  - 99,000 deaths; $26-33 billion in excess costs
- Long-term care (15,965 facilities, 3.2million residents)
  - VA healthcare data: HAI prevalence: 5.2% in 133 facilities
  - PA data: 16,729 HAIs reported from 645 LTCFs over 6 months
- Ambulatory surgical centers: >5,300 facilities
  - Outbreaks of viral hepatitis infections
- Hemodialysis centers: >5,000 facilities
  - Catheter-related bloodstream infections: 4.2 per 100 patient months
  - Incidence of methicillin-resistant *Staphylococcus aureus (MRSA) bloodstream infection: 100 x greater than in nondialysis population*

NCHS 2009; Tsan, AJIC, 2008; Klevens, Semin Dialysis, 2008; PA PSAAnnual report 2009; Klevins, Pub Health Report 2007
Thompson, Ann Intern Med 2009 MMWR May 16, 2008; 57:19 Kallen, 19th Annual SHEA Meeting, San Diego, 2009

http://www.hhs.gov/ash/initiatives/hai/actionplan/



http://innovations.cms.gov/areas-of-focus/patient-care-models/partnerships-for-patients/

http://www.cdc.gov/hai/recovery act

Role of Healthcare in Emergence of Antibiotic Resistance

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

Case of an Emerging Multidrug-Resistant Organism….

MAJOR ARTICLE

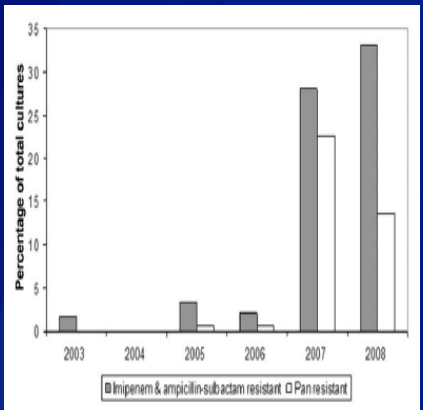
Clinical Infectious Diseases 2010; 50(12):1611–1616

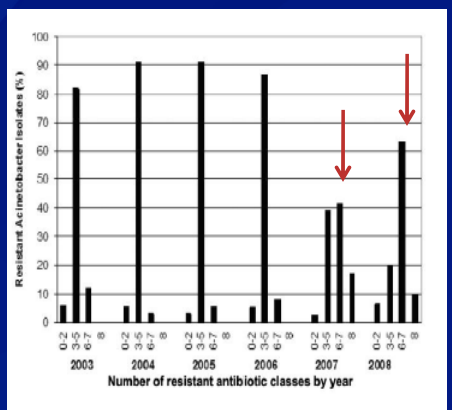
Multidrug-Resistant *Acinetobacter baumannii*: An Emerging Pathogen among Older Adults in Community Hospitals and Nursing Homes

D. M. Sengstock,[1,2] R. Thyagarajan,[1,2] J. Apalara,[1] A. Mira,[1] T. Chopra,[2] and K. S. Kaye[2]
[1]Internal Medicine/Geriatrics, Oakwood Hospital, Dearborn, and [2]Department of Internal Medicine, Wayne State University, Detroit, Michigan

- Laboratory query for all *Acinetobacter baumannii* identified in clinical isolates from 4 community hospitals over a 5 year period
- Classified as nosocomial, NH-associated, or community-associated
- Analysis limited to individuals >60 yrs old and not presenting from any other hospital setting

Multidrug-Resistance Emerges Quickly

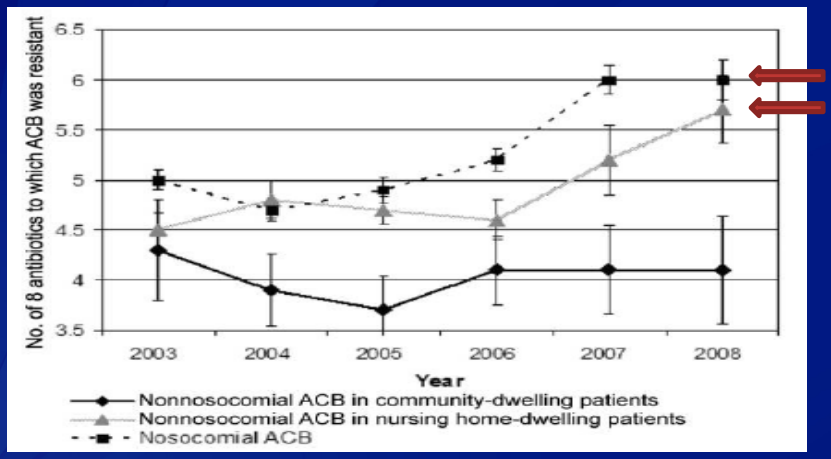




- Over 5 year period, *Acinetobacter* resistance increased dramatically
- Culture sources: Respiratory secretions (56%); Wounds (22%); Urine (12%)

Sengstock DM, et al. Clin Infect Dis. 2010 50(12): 1611-1616

Healthcare Facilities are the Source of Multidrug-Resistance Organisms



Sengstock DM, et al. Clin Infect Dis. 2010 50(12): 1611-1616

Critical Message about Care Transitions

The increase in prevalence of *Acinetobacter* strains in nursing homes and the degree of antibiotic resistance among these strains is extremely concerning. As the current study demonstrates, the degree of antibiotic resistance among "hospital-acquired" *Acinetobacter* cultures increased during the study period in parallel with the degree of resistance among *Acinetobacter* isolates from nursing home–dwelling patients. The epidemiology of *Acinetobacter* infection among older adults in this study indicates the existence of a hospital–nursing home "coupling." This coupling supports a continuous circuit that nurtures the dissemination of multidrug-resistant *Acinetobacter* strains among both types of health care facility. Consequently, coordinated regional efforts are needed to control the spread of this pathogen. Long-term care facilities, despite their vulnerable populations, generally have few resources for infection surveillance and prevention.

Sengstock DM, et al. Clin Infect Dis. 2010 50(12): 1611-1616

Multidrug-Resistance Organisms (MDRO)

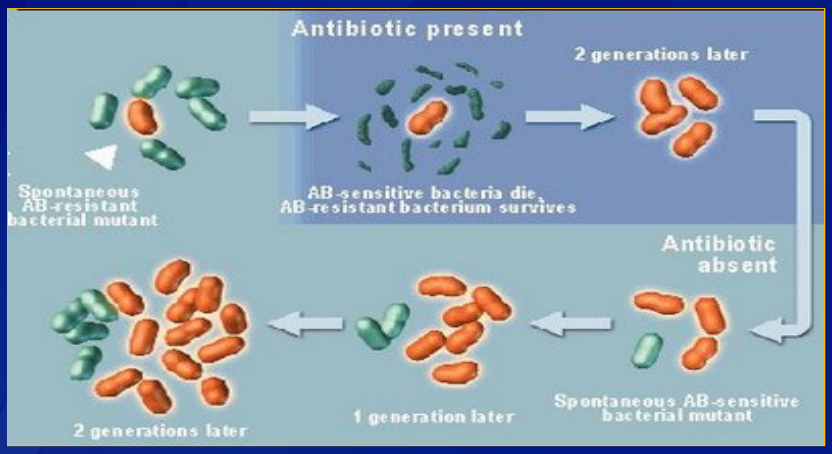
EMERGENCE

- Antibiotic pressure
  - Most common predictor of antibiotic resistance is prior exposure
- Device utilization
  - Biofilm formation on central lines, urinary catheters, etc.

SPREAD

- Patient to patient transmission via healthcare workers
- Environmental / equipment contamination
- Role of colonization pressure on acquisition

Resistance from Antibiotic Pressure



- At first most of the bacteria can be killed by the drug (green)
- But, once they are wiped out, the resistant bugs take over (red)

Antibiotic Use Drives Resistance

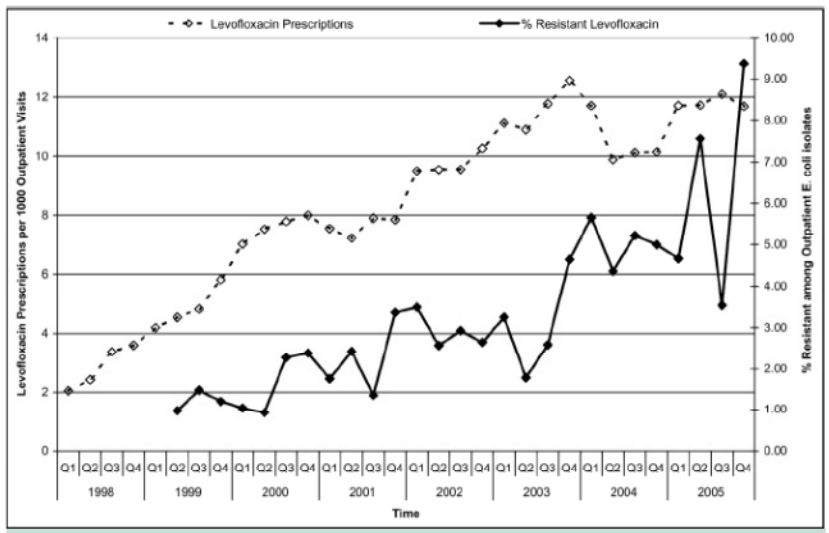
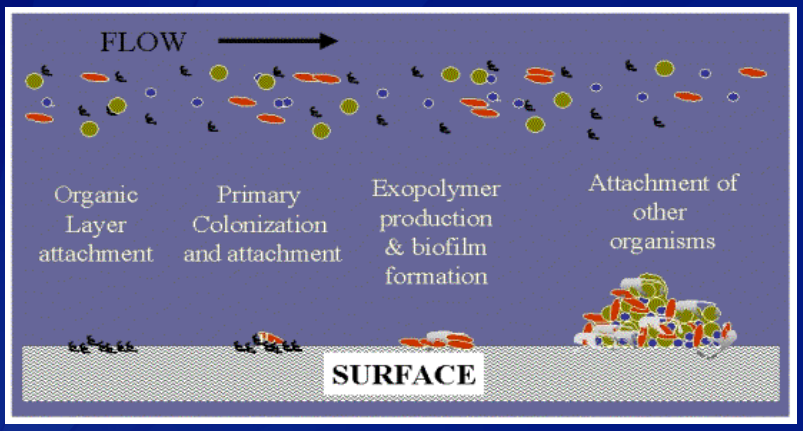


Figure 1 Levofloxacin use and outpatient *Escherichia coli* resistance to levofloxacin versus time.

Johnson et al. Am J. Med. 2008; 121: 876-84

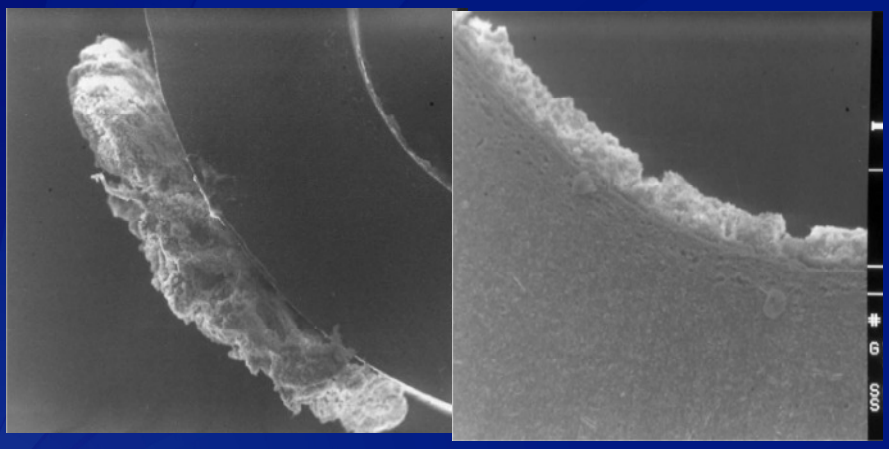
Biofilm Formation on Device Surfaces



- Biofilm: An collection of bacteria within a sticky film that forms a community on the surface of a device

http://www.ul.ie/elements/Issue7/Biofilm%20Information.htm

Biofilm on an Indwelling Catheter



Tenke, P et al. World J. Urol. 2006; 24: 13-20

Resistance Develops within Biofilms

- Bacteria within a biofilm are grow every differently from those floating around freely
  - These changes in their growth make our antibiotics less effective
- Antibiotics can't penetrate the biofilm to get to the bacteria
  - This leads to much less drug available to treat the bugs
- Bacteria within the biofilm can talk to each other and share the traits that allow some to be resistant
  - Over time more and more of them become resistant as well

Tenke, P et al. World J. Urol. 2006; 24: 13-20

Ways Resistance Spreads in Healthcare

X marks VRE isolated in this room

Image from Abstract: The Risk of Hand and Glove Contamination after Contact with a VRE (+) Patient Environment. Hayden M, ICAAC, 2001, Chicago, IL.

Unit A
Colonization pressure
=1 × days in unit

Unit B
Colonization pressure
=5 × days in unit

Pathogen	Survival	Data Strength	Transmission Settings
C difficile	Months	3+	Healthcare facilities
MRSA	Days-weeks	3+	Burn units
VRE	Days-weeks	3+	Healthcare – higher risk areas
Acinetobacter	33 days	2/3+	Wet or dry environments
Pseudomonas aeruginosa	7 hours	1+	Wet environments

Adapted from Hota. *Clin Infect Dis*. 2004;39:1182-1189.

Dubberke ER, et al. *Clin Infect Dis*. 2007;45:1543-1549.
Dubberke ER et al. Arch InternMed.2007;167(10):1092-70

Key Prevention Strategies

- Assessing hand hygiene practices
- Implementing Contact Precautions
- Equipment and Environmental disinfection
- Careful device utilization
- Antibiotic stewardship
- Inter-facility communication

Case Study on Care Transitions

- A nursing home resident was transferred to a local ED for symptoms of worsening lower extremity swelling and shortness of breath
  - PMHx included h/x CAD, DM with neuropathy, BPH
  - No fever, focal complaints, or leukocytosis on admission
- Diagnosed with worsening congestive heart failure admitted for cardiac monitoring and diuresis
- A urinary catheter was placed at the time of admission and a specimen was sent for UA/culture in ED.
  - Based on an abnormal UA, the patient was started on antibiotics

Case Study (continued)

- After treatment for CHF and the positive urine culture, the patient was discharged backed to the LTC facility with the catheter in place.
- Prior to removing the urinary catheter a repeat culture was sent which grew VRE
  - A second course of antibiotics was initiated
- Two weeks later the resident developed diarrhea, fever and hypotension resulting in transfer back to acute care hospital
  - Stool sample was positive C. Diff toxin test.

Issues Raised by this Case Study

- Is the practice of screening urine cultures on admission a valuable strategy?
  - What are the pros/cons
- Did the resident continue to need the urinary catheter once the CHF was managed?
  - How is resident functionality communicated at time of transfer
- How are antibiotics used in both acute/LTC facilities in this shared population?
  - Who is accountable for the complications of antibiotic use?

Urinary Catheter Use

- 15-25% of hospitalized patients may receive a urinary catheter
  - 5% in long-stay population in LTCF
  - 10-12% in post-acute care population in LTCF
- Often placed/maintained for inappropriate indications
  - 28% of physicians unaware of catheter status
  - Documentation of indication/presence of catheter available for <50% of patients with device

Warren JW. Int J Antimicrob Agents. 2001;17:299-303 Weinstein JW, et al. ICHE.1999;20:543-548
Jain P, et al. Arch Intern Med. 1995;155:1425-1429 Saint S, et al. Am J Med. 2000;109:476-480
Rogers MA, et al. J Am Geriatr Soc. 2008;56:854-861; Chenoweth C et al Inf Dis Clin N Am 2011: 103-115

Careful Device Utilization

- Know the patients/residents with indwelling medical devices
  - May require focused infection surveillance
- Continually assess the ongoing need for devices
  - Develop a bladder protocol for urinary catheter removal
  - Make device use part of daily assessments
- Ensure staff are comfortable and trained on handling/maintenance of medical devices
  - Document device insertion/ maintenance practices
  - Standardize assessment of device functionality

Reasons to Improve Antibiotic Use in Healthcare

- Antibiotics are misused in hospitals, nursing homes and ambulatory settings
- Antibiotic misuse adversely impacts patients and society
  - Adverse side effects, promotes resistance and secondary complications (*C. difficile*)
- Improving antibiotic use improves patient outcomes and has cost savings

http://www.cdc.gov/getsmart/healthcare/inpatient-stewardship.html#Facts

Examples of Antibiotic Misuse

- Given when they are not needed
- Continued when they are no longer necessary
- Given at the wrong dose
- Broad spectrum agents are used to treat very susceptible bacteria
- The wrong antibiotic is given to treat an infection

http://www.cdc.gov/getsmart/healthcare/inpatient-stewardship.html#Facts

Antibiotic Stewardship: Keys for Success

- Identify a Physician Champion
  - Must be influential among peers
- Enlist support from Leadership
- Tailor efforts to address local problems
- Identify outcome measurements to track impact
  - Examples: Antibiotic costs, adverse side effects, C difficile rates

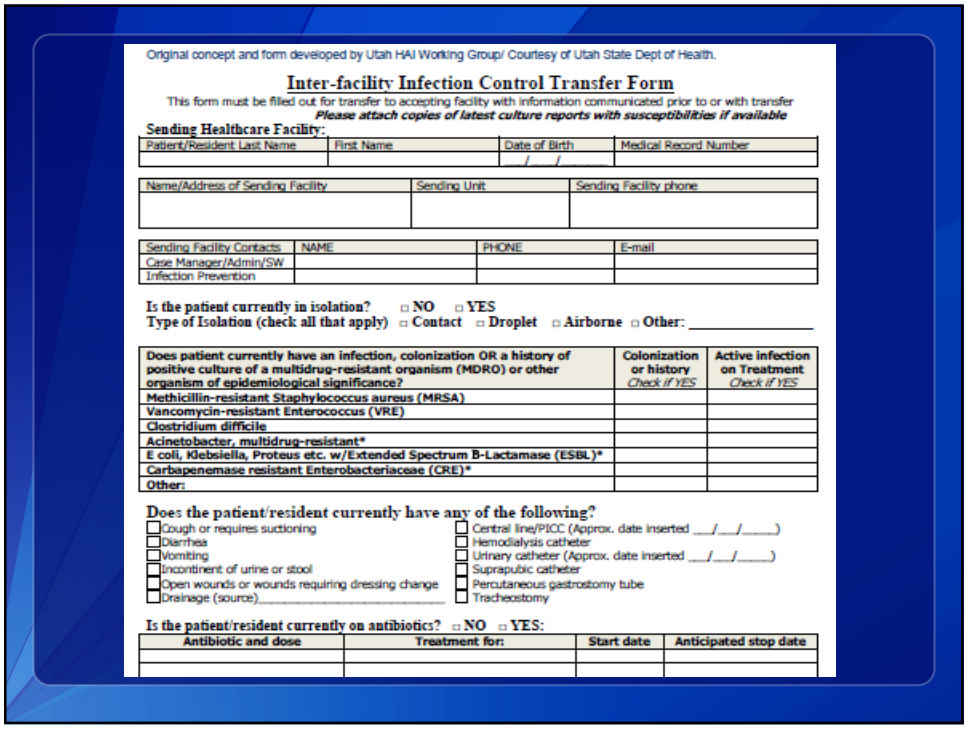
http://www.cdc.gov/getsmart/healthcare/improve-efforts/keys.html

Antibiotic Stewardship

- Careful antibiotic use is a critical component in the control of MDROs
- Know the frequency/indications for antibiotic use by medical providers in your facility
  - Apply criteria to assess utilization in a standard way
- Develop mechanisms for communicating rationale and plan for antibiotic courses when person leaves your facility
  - Ensure documentation of drug, indication and duration is available

Inter-facility Communication

- Mechanism for communicating MDRO carriage and other risk factors at time of transfer between facilities
- Critical components:
  - MDRO history of current infection or carriage
  - Device utilization
  - Current antibiotic treatments (indication/duration)
  - Bedside care issues (wounds, continence, etc)



Original concept and form developed by Utah HAI Working Group/ Courtesy of Utah State Dept of Health.

Inter-facility Infection Control Transfer Form

This form must be filled out for transfer to accepting facility with information communicated prior to or with transfer

Please attach copies of latest culture reports with susceptibilities if available

Sending Healthcare Facility:

Patient/Resident Last Name	First Name	Date of Birth	Medical Record Number
		___/___/_____	

Name/Address of Sending Facility	Sending Unit	Sending Facility phone

Sending Facility Contacts	NAME	PHONE	E-mail
Case Manager/Admin/SW			
Infection Prevention			

Is the patient currently in isolation? ☐ NO ☐ YES
Type of Isolation (check all that apply) ☐ Contact ☐ Droplet ☐ Airborne ☐ Other: _____

Does patient currently have an infection, colonization OR a history of positive culture of a multidrug-resistant organism (MDRO) or other organism of epidemiological significance?	Colonization or history *Check if YES*	Active infection on Treatment *Check if YES*
Methicillin-resistant Staphylococcus aureus (MRSA)		
Vancomycin-resistant Enterococcus (VRE)		
Clostridium difficile		
Acinetobacter, multidrug-resistant*		
E coli, Klebsiella, Proteus etc. w/Extended Spectrum B-Lactamase (ESBL)*		
Carbapenemase resistant Enterobacteriaceae (CRE)*		
Other:		

Does the patient/resident currently have any of the following?

☐ Cough or requires suctioning
☐ Diarrhea
☐ Vomiting
☐ Incontinent of urine or stool
☐ Open wounds or wounds requiring dressing change
☐ Drainage (source)_____
☐ Central line/PICC (Approx. date inserted ___/___/_____)
☐ Hemodialysis catheter
☐ Urinary catheter (Approx. date inserted ___/___/_____)
☐ Suprapubic catheter
☐ Percutaneous gastrostomy tube
☐ Tracheostomy

Is the patient/resident currently on antibiotics? ☐ NO ☐ YES:

Antibiotic and dose	Treatment for:	Start date	Anticipated stop date

Barriers to Communication during Inter-facility Transfers

- Survey distributed to NH administrators across the state of NY (~30% response)
- Main perceived barriers:
  - Hospital providers put limited effort in the transfer process; unfamiliar with the patient; lacked time; put low priority on the process
  - Sudden/unanticipated transfers or transfers on off-shifts (nights/weekends)
- Barriers more pronounced for urban NHs, those interacting with larger hospitals

Shah F et al. J Am Med Dir. 2010; 11: 239-245

Factors Related to Improved Communication during Transfers

- NH and hospitals sharing common pharmacy/laboratory services
- Cross-site visits among NH and hospital staff
- Greater consistency in goals of care between hospitals and NHs
- Efforts in place to improve communication at the time of transfer

Shah F et al. J Am Med Dir. 2010; 11: 239-245

Steps to Improved Adoption of Communication Form

- Meetings between hospital and nursing home staff counterparts
  - Admission coordinators, social workers, nursing directors
- Align hospital, nursing home, and home health quality initiatives
  - CMS focus on hospital readmission rates and care transitions
  - Continue building on established Quality Improvement efforts

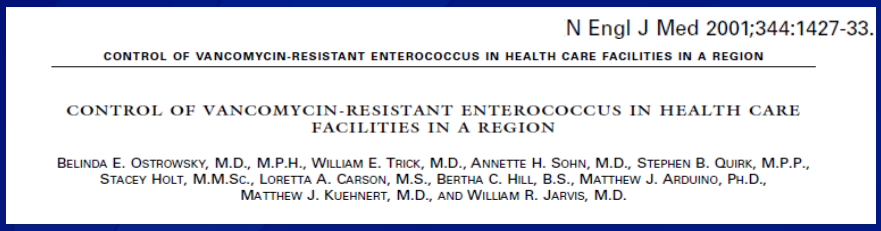
http://www.medscape.com/viewarticle/487323_5

Steps to Improved Adoption of Communication Form

- Facilitate relationships between nursing home medical directors and inpatient hospital providers and emergency department providers
  - Presentations at educational forums (e.g., Grand Rounds, Dept staff meetings, etc)
  - Maintain updated provider contact list for ED physicians and NH medical staff

http://www.medscape.com/viewarticle/487323_5

Story of Success: Vancomycin Resistant Enterococcus (VRE) Prevention



N Engl J Med 2001;344:1427-33.

CONTROL OF VANCOMYCIN-RESISTANT ENTEROCOCCUS IN HEALTH CARE FACILITIES IN A REGION

CONTROL OF VANCOMYCIN-RESISTANT ENTEROCOCCUS IN HEALTH CARE FACILITIES IN A REGION

BELINDA E. OSTROWSKY, M.D., M.P.H., WILLIAM E. TRICK, M.D., ANNETTE H. SOHN, M.D., STEPHEN B. QUIRK, M.P.P., STACEY HOLT, M.M.SC., LORETTA A. CARSON, M.S., BERTHA C. HILL, B.S., MATTHEW J. ARDUINO, PH.D., MATTHEW J. KUEHNERT, M.D., AND WILLIAM R. JARVIS, M.D.

- Describes the impact of regionally implemented infection control strategies to address VRE emerging in the Siouxland region of Iowa, Nebraska and S. Dakota
- Three annual point prevalence surveys (active surveillance) for VRE among patients/residents in participating acute/long-term care facilities

VRE Prevalence Decreased following Prevention Interventions

- 32 Facilities participated in 1997 and 1998 (4 acute/ 28 LTC) vs. 30 in1999 (4 acute/ 26 LTC)
- Overall 85%-89% of eligible patients/ residents cultured each year
  - 52-59% in acute care
  - 90-95% in LTC

Type of Facility	Colonization with VRE		
	1997	1998	1999
	no. of patients (%)		
All	40 (2.2)	26 (1.4)	9 (0.5)
Acute care	10 (6.6)	9 (5.5)	0
Long-term care	30 (1.7)	17 (1.0)	9 (0.5)

Ostrowsky BE et al. New Eng J Med 2001 344: 1427-1433

Critical Message about Collaboration

grams at the various facilities. By following the CDC recommendations, these health care facilities were able to turn the tide and reduce in long-term care facilities or eliminate in acute care facilities the transmission of vancomycin-resistant enterococci. They have also prevented the emergence of serious infections with vancomycin-resistant enterococci, as evidenced by the fact that there have been no bloodstream or invasive infections with vancomycin-resistant enterococci in these facilities since the intervention. In addition, the collaboration among the facilities has fostered communication and eased the transfer of patients colonized with vancomycin-resistant enterococci between facilities, in contrast to the usual limitation of access for such patients.

Ostrowsky BE et al. New Eng J Med 2001 344: 1427-1433

Thank you!!

Email: nstone@cdc.gov with questions/comments

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333
Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion