Results of Ranking State HAI Priorities
Healthcare Associated Infections Advisory Committee
April 2011

Group Rank	Average Score*	Score Range	Initiative	Comments
1	**2.63**	**2 -8**	ITEM C: Hospitals to report Clostridum difficile using NHSN lab ID module	• Relatively low impact on hospital reporting • Anyway to make this low barrier to entry? Direct from lab? • Rated highest priority because of high number of cases both nationally and at the state level; high morbidity/mortality and cost associated with Clostridium difficile. • There is strong indication that *C.difficile* is an important problem and the data collection burden would probably be relatively manageable within the current infrastructure. • C-diff has a high cost and high prevalence. Could we suggest we include Oregon State Hospital in the reporting? • C. diff cases are increasing, virulence is increasing, but there is little data to support that. It is an HAI that should be reported publicly for the same reasons that we report on the others.
2	**4.25**	**1 - 7**	ITEM E: Hospitals to report Surgical Care Improvement Project (SCIP) Infection Measure 7: surgical patients with urinary catheter removed on Postoperative Day 1 or Postoperative Day 2	• Very low barriers to implementation • Rated 4 because of high number of cases and associated costs of care. • Many patients have bladder catheters and the infection rates in general are relatively low so this does not seem like a high priority for HAI prevention resources.
3	**4.27**	**1 - 6**	ITEM G: Long-Term Care (Nursing Homes) HAI Reporting	• NHSN tool may not be ready until Oct 2011, but pre-work could be done? • Too vague • Important due to rising acuity, patient volumes – revolving door between hospital and nursing home • Rated 6 because of benefit of reporting on Clostridium Difficile. • HAIs, in particular *C. difficile,* are asignificant concern and mandated reporting for these facilities might be manageable

*Average Score: the lowest score = highest priority.

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				within the current infrastructure. It could possibly be helpful to look at BSIs as well in this in LTC but the feasibility and use for this would need further discussion prior to implementation.
3	**4.27**	**1 - 8**	ITEM H: Ambulatory Surgical Center Reporting	• Very high volume of cases; increasing; and we know little; actual surveillance targets unknown - await survey results • Rated low because of lack of connection between infection control findings cited and data to be reported to NHSN. Is a clinician with poor judgment who reuses syringes an infection control issue or a medical staff issue. Will reporting to NHSN stop this behavior? Most of these issues are related to employees/physicians abusing drugs. I agree that an education campaign and stricter CMS surveys are necessary, but am not certain that reporting to NHSN will solve this issue. • Too vague • Growing rapidly in volume and acuity • ASC reporting may be important but we really don't feel that there is adequate data indicating that these facilities should be a top priority for HAI prevention. Patients are in these facilities for short periods of time and the procedures commonly performed are not necessarily indicative of those having the greatest threat for HAI when compared to certain other medical facility types. With more data or with further expansion of procedures performed at ASCs this determination might well change. • The number of facilities and the utilization of ASCs continues to grow. ASCs are performing more complicated procedures every year.
5	**4.38**	**1 - 7**	ITEM B: Expand Public Health Invasive MRSA Emerging Infections Program (EIP) to be statewide	• Tri-county now; requires statewide rules, spread to other hospitals • Not sure of benefit • Rated high priority because of high number of cases and

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				morbidity/mortality. System already in place at the Tri-County Level. • We think that expanding EIP surveillance of MRSA statewide would be very difficult without serious expansion of resources and thus is likely to be an unmanageable project. We did consider possible alternatives such as simply monitoring bacteremia or not differentiating between community and healthcare associated cases but in such limited implementation, the data, while easier to collect, would have questionable meaning for HAI related decision making • Structure is in place
6	**4.47**	**2 - 8**	ITEM D: Hospitals to report surgical site infections associated with prosthetic devices	• Probably monitored by hospitals but not reported; those that don't track using NHSN would need to do so; could be few hospitals involved, fewer ASCs • Too broad • High morbidity associated with these infections, though case count is not actionable due to lack of denominated data, risk adjustment, definition of "implant" does h-pro, k-pro act as surrogate marker? • Perhaps choosing a more narrow procedure that nosocomial infection leads to high morbidity/mortality i.e., vascular procedure, sternotomies, craniotomies. In addition to expanding the procedure list, perhaps risk adjustment would give public a more refined view of reported data. • Rated as 5 because of high number of cases and morbidity/mortality. This could be too time consuming for hospital personnel. This could be used in the Ambulatory Surgical Center setting as well. • Item D appears to be likely a very strong candidate for importance in presentation of HAI but unfortunately data complexities in the current system make this a better candidate for future, rather than immediate work

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Group Rank	Average Score*	Score Range	Initiative	Comments
7	**4.80**	**1 - 8**	ITEM A: Statewide MRSA active surveillance standards	• Mixed evidence for effectiveness of AST for MRSA • Too little data exists for recommendations • Rated as high priority because of high number of cases, morbidity/mortality and cost. Creates state-wide standard for MRSA surveillance. • Implementation of item A appears to be a relatively manageable measure that could be carried out to better understand current levels of active surveillance of MRSA, an important pathogen for HAIs. • MRSA surveillance has no standardization, therefore it is impossible to compare rates, or to even know how you are doing as an institution. If there were external pressure to standardize, it would give us leverage to make those changes.
8	**6.53**	**1 - 8**	ITEM F: Composite measure for HAI for facilities	• not really feasible at this time; use as a performance measure unknown; may require MedMined • Not applicable • Cant' implement • Too expensive for facilities without enough value. • Item F is simply too general to be of much use. We are still struggling to attain high quality data on more specific levels so expanding to a generalized measure would simply increase concerns regarding accuracy and meaningfullness of data.

Additional comments:

- We think that dyalisis related blood stream infections and hepatitis b and c seroconversion in dyalsis facilities are potentially very important issues that should also be considered as potential priorities for HAI reporting.
- According to the recently released draft 10SOW from CMS the focus in the next 3 years will be CLABSI, CAUTI, Cdiff and surgical site infections for hospitals.
- In the scheme of national issues, I believe that the importance of ESBL gram-negative rods incidence, morbidity and mortality is as important as MRSA infections. I know the issue is not on the list.

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Item A: Statewide MRSA Active Surveillance Testing (AST) Standards

Current Activity in Oregon: No statewide standards for MRSA active surveillance testing (AST) in the state exist.

When clinical culture results alone are used to identify MRSA carriers, more than half of all MRSA-colonized patients remain unrecognized.[1] The rationale for AST is to identify all colonized patients so that the additional precautions can be applied (e.g., contact precautions). To date, studies evaluating AST have had mixed results: Huang et al.[2] found the largest decrease in MRSA bacteremia associated with institution of AST; Robicsek et al.[3] found significant decrease in MRSA disease with universal institution of AST combined with decolonization regiments; Harbeth et al.[4] found no significant decrease in MRSA disease with institution of rapid AST.

In addition, the best practice to perform AST is unknown. The polymerase chain reaction lab test provides more rapid results than a laboratory culture, but it is more expensive and technically more challenging. It is also unknown what body sites should be tested; nares are most common, but wounds, axillae, and groin areas can also be tested and provide more testing results. Testing is typically conducted upon admission; it can be repeated; and discharge testing provides information if the pathogen was transmitted during hospitalization. While some facilities employ facility-wide AST, it is more common to test patients admitted to high-risk areas (e.g., ICUs).

Seriousness (Mortality/Morbidity):

National population-based estimates of invasive MRSA infections[5]:

- 94,360 invasive infections annually in the US
- Associated with 18,650 deaths each year
- 86% of all invasive MRSA infections are healthcare associated

Treatment options for MRSA are limited and result in higher mortality and morbidity than other organisms that do not demonstrate resistance to antibiotics. The high prevalence of MRSA influences unfavorable antibiotic prescribing, which contributes to further spread of resistance.

Volume of Pathogen in Oregon:

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[1] Salgado CD, Farr BM. Infect Control Hosp Epidemiol 2006; 27:116-121.

[2] Huang et al. Clin Infect Dis 2006: 43:971-978.

[3] Robicsek et al. Ann Intern Med 2008: 148:409-418.

[4] Harbath et al. JAMA 2008;299:1149-1157.

[5] Klevens et al. JAMA 2007; 298:1763-71.

The 2008 Oregon MRSA Surveillance Report indicates that a total of 267 cases of invasive MRSA were identified in the Portland tri-County area, for an overall incidence of 16.5/100,000 persons[6]. Since the Oregon Active Bacterial Core Surveillance (ABC) program was initiated in 2004 to track invasive MRSA, the reported incidence of invasive MRSA has decreased 38%, from 26.6 per 100,000 persons to 16.5 per 100,000 persons.

Existence of Evidence-Based Solutions: If patients are identified with MRSA colonization or infection, guidelines of the standard practice of care exist, including those of the Infectious Disease Society of America (ISDA)[7], Joint Commission and the CDC. Prevention strategies include hand hygiene, contact precautions, recognizing previously colonized patients, rapid reporting MRSA lab results, and providing MRSA education for healthcare providers.

Healthcare Costs: Costs related to the impact on overall healthcare costs were not identified. However, CDC notes that MRSA is a marker for ability to contain transmission of important pathogens in the healthcare setting. Programs that successfully prevent MRSA transmission are likely to have benefit when applied to other epidemiologically important healthcare pathogens that spread by patient-to-patient transmission.[8]

Applicability to other care settings: The AST survey could be for other care settings. AST standards could be applied to other care settings.

Barriers to implementation: Surveys already exist. We have obtained two surveys: one from the CDC and another from the California Department of Health[9]. The effort to obtain information regarding MRSA AST practices in the state is low. It would consist of creating the Survey Monkey questionnaire and distributing it to hospitals. It is estimated hospitals would take less than 20 minutes to complete the survey. Barriers to implement MRSA AST is unknown; this issue could be better assessed after collecting survey results. If AST standards were established, it is unknown how the state would enforce these standards

[6] Office of Disease Prevention & Epidemiology, Oregon Department of Human Services, Methicillin-Resistant Staphylococcus aureus (MRSA) Surveillance Report 2008. Updated March 2010. http://www.oregon.gov/DHS/ph/acd/diseases/mrsa/mrsa08.pdf

[7] Liu et al. Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant *Staphylococcus Aureus* Infections in Adults and Children. Clinical Infectious Diseases. Published online January 2011. http://cid.oxfordjournals.org/content/early/2011/01/04/cid.ciq146.full

[8] Jernigan, J and A. Kallen. Methicilin-resitant *Staphylococcus aureus* (MRSA) Infections Activity C:ELC Prevention Collaboratives, January 19, 2010. http://www.cdc.gov/HAI/pdfs/toolkits/MRSA_toolkit_white_020910_v2.pdf

[9] Petersen, A. et al. Hospital methicillin-resistant Staphylococcus aureus active surveillance practices in Los Angeles County: Implications of legislation based infection control, 2008. Am J Infect Control 2010;38:653-6.

Item B: Expand Public Health Invasive MRSA Emerging Infections Program to be Statewide

Current Activity in Oregon: Oregon is one of ten Emerging Infections Program (EIP) sites in the US. One of the targets of the EIP program is "invasive MRSA." Invasive MRSA represents the most serious infections and is defined as the first positive culture from a normally sterile site (e.g., taken from blood, bone, or internal organ.) The reporting of MRSA data extends to only the Portland Tri-County residents, which represents about 43% of the state's population. The project performs two general tasks: (1) Tri-county hospital laboratories submit MRSA isolates to the Oregon State Public Health Laboratory for identification and (2) Public Health staff review laboratory records and health records of each case to collect additional data and classify each case according to three strata: healthcare onset; healthcare-associated, community onset; and community onset.

Seriousness (Mortality/Morbidity): (See discussion under Item A)

Volume of Pathogen in Oregon: (See discussion under Item A)

Existence of Evidence-Based Solutions: (See discussion under Item A)

Healthcare Costs: (See discussion under Item A)

Applicability to other care settings: The EIP MRSA program is conducted only in hospitals.

Barriers to implementation: The tri-county EIP MRSA program has been in place in Oregon since 2004. To extend lab reporting statewide would require the Public Health Department to write rules to cover the entire state. It is unclear what the requirements would be to have staff review records to classify MRSA.

Item C: Hospitals to Report Clostridium Difficile using NHSN LAB ID Module

Current Activity in Oregon: Oregon is currently not reporting Clostridium difficile in the state. In the HAI Prevention Collaborative, Clostridium difficile is one of the targets. Participants can report the target using one of three methods: (1) NHSN Lab ID, (2) NHSN event reporting, or (3) using a definition provided by the Oregon Patient Safety Commission.

Seriousness (Mortality/Morbidity):

Statistics regarding Clostridium difficile:[10][11][12][13]

- Hospital-acquired, hospital onset: 165,000 cases, $1.3 billion in excess costs, and 9,000 deaths annually.
- Hospital-acquired, post discharge onset (up to 4 weeks): 50,000 cases, $0.3 billion in excess costs, and 3,000 deaths annually
- Nursing home-onset: 263,000 cases, $2.2 billion in excess costs, and 16,500 deaths annually.

In 2004, a new epidemic strain of Clostridium difficile causing hospital outbreaks was identified.[14] This epidemic stain appears to be more virulent, and is more resistant to the antibiotic group known as floroquinolones.

Volume of Pathogen in Oregon:

The overall incidence of Clostridium difficile-associated disease in Oregon was 3.5 case patients per 10,000 residents in 2002. Incidence increased from 1.4 to 3.3 per 1,000 hospital discharges from 1995 to 2002.[15]

Existence of Evidence-Based Solutions: Evidence-based solutions do exist and include contact precautions for the duration of diarrhea; hand hygiene in compliance with CDC/WHO protocol; cleaning and disinfection of equipment and environment; laboratory-based alert system for

[10] Campbell et al. Infect Control Hosp Epidemiol. 2009:30:523-33.

[11] Dubberke et al. Clin Infect Dis. 2008; 46:497-504.

[12] Dubberke et al. Emerg Infect Dis. 2008;14:1031-8.

[13] Exlixhauser et al. HCUP Statistical Brief #50. 2008.

[14] Information about the current strain of Clostridium difficile. Centers for Disease Control and Prevention. http://www.cdc.gov/HAI/organisms/cdiff/Cdiff-current-strain.html

[15] Chandler et al, 2007. Clostridium difficile-Associated Disease in Oregon: Increasing Incidence and Hospital-Level Risk Factors. Infection Control and Epidemiolog., 28(2): 116-22.

immediate notification of positive test results; and education regarding Clostridium difficile to healthcare personnel, administration, patient and families.[16]

Healthcare Costs: See section above regarding Seriousness (Mortality/Morbidity).

Applicability to other care settings: As noted under the Seriousness (Mortality/Morbidity) section above, *Clostridium difficile* is an important reduction target in nursing home settings as well.

Barriers to implementation: This option would require facilities to use the NHSN Lab ID module which requires the input of nine data fields for each report of Clostridium difficile (some fields are prefilled).

[16] http://www.cdc.gov/HAI/organisms/cdiff/Cdiff_infect.html. Dubberke et al. Infect Control Hosp Epidemiol 2008;29:S81-92.

Item D: Hospitals to Report Surgical Site Infections Associated with Prosthesis

Current Activity in Oregon: Oregon currently requires hospitals to report six surgical site infections: coronary artery bypass graft (with donor incision), knee prosthesis, hip prosthesis, colon surgery, abdominal hysterectomy, and laminectomy. Of these required surgeries, in general, the knee prosthesis and hip prosthesis require implants. This proposal is to have hospitals report all surgeries which include any type of implant during the surgery. Implants are non-human-derived object, material, or tissue that is permanently placed in a patient during an operative procedure and is not routinely manipulated for diagnostic or therapeutic purposes. Examples include: porcine or synthetic heart valves, mechanical heart, metal rods, mesh, sternal wires, screws, cement and other devices.

Seriousness (Mortality/Morbidity):

Statistics on surgical site infections related to prosthetic devices were not available. Statistics on surgical site infections (SSIs) in general include:[17][18]

- ~300,000 per year (17% of all HAI, second only to urinary tract infections.
- 2%-5% of patients undergoing inpatient surgery
- 3% mortality
- Patients with SSIs have 2 to 11 times higher risk of death
- 75% of deaths among patients with SSIs are directly attributable to SSI
- SSIs can cause long-term disabilities

One way to obtain infection data on surgical procedures with implants is to require the reporting of all NHSN procedures that could potentially include an implant and to filter procedures that are noted to have an implant. A sample of potential procedures with implants is presented below, with national infection rates and volumes in Oregon hospitals.

NHSN SSI procedure	Infection Rate Pooled Mean (RC 0-3)	Hospital Volume, 2007	Expected Infections(Rate * Volume)	Hospitals (≥20 procedures)
Abdominal aortic aneurysm repair (AAA)	2.12-6.46	261	6	5
Arteriovenostomy for renal dialysis (AVSD)	1.27	183	2	2

[17] Anderson DN et al. Strategies to prevent surgical site infections in acute care hospitals.

[18] Infect Control Hosp Epidemiol 2008;29:S51-S61 for individual references.

NHSN SSI procedure	Infection Rate Pooled Mean (RC 0-3)	Hospital Volume, 2007	Expected Infections(Rate * Volume)	Hospitals (≥20 procedures)
Breast surgery (BRST)	.95-6.36	1216	120	13
Cardiac surgery (CARD)	1.10-1.84	2129	23	12
Pacemaker (PACE)	0.44	2862	13	21
Peripheral vascular bypass surgery (PVBY)	2.93-6.98	942	28	12
Spinal fusion (FUSN)	.70-4.15	5310	37	20
Ventricular shunt (VSHN)	4.04-5.93	900	36	9

Volume of Pathogen in Oregon: Unknown.

Existence of Evidence-Based Solutions: Practices to address surgical site infections with strong evidence do exist. These include administering antimicrobial prophylaxis, identifying and treating remote infections before elective operations, selective and appropriate hair removal at the surgical site, and use of antiseptic agents for skin preparation.[19] [20]

Healthcare Costs: Costs specific to surgical site infections related to implants were not found. Estimated healthcare costs associated with surgical site infections are summarized below:[21]

- Increases hospital length of stay about 7 to 10 days.
- An additional $3,000 to $29,000 per surgical site infection, depending on the procedure and pathogen.
- Up to $10 billion annually
- Most estimates are based on inpatient costs and do not include additional costs of rehospitalization, post-discharge outpatient expenses, and long-term disabilities.

[19] Fry DE. Surgical Site Infections and the Surgical Care Improvement Project (SCIP): Evolution of National Quality Measures. Surg Infect 2008;9(6):579-84

[20] Anderson DJ et al. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol 2008: 29: S51-S61.

[21] Infect Control Hosp Epidemiol 2008;29:S51-S61 for individual references

Applicability to other care settings: This may be applicable to ambulatory surgical centers.

Barriers to implementation: There is no cost to use NHSN; it is a free, web-based application. It is likely not possible that all hospitals can report all surgical procedures in NHSN at this time. When electronic reporting methods improve in hospitals, this proposal may be more feasible.

Item E: Hospitals to Report Surgical Care Improvement Project Measure Infection 7 (SCIP-Inf-7) regarding Post Surgical Catheter Removal.

Current Activity in Oregon: Oregon does not have any reporting requirements related to catheter associated urinary tract infections (CAUTI). Oregon does have a reporting requirement for long-term care facilities to report urinary tract infections using the CMS reporting system.

Seriousness (Mortality/Morbidity): CAUTI are the most common type of healthcare-associated infection. CAUTI represent greater than 30% of HAIs reported in the NHSN. It is estimated that more than 560,000 nosocomial UTIs occur annually.[22] It also estimated that 13,000 deaths are attributable to CAUTI annually; and CAUTI is the leading cause of secondary bloodstream infections with a 10% mortality rate.[23]

It is estimated that 15-20% of hospitalized patients are catheterized[24]; 5-10% (75,000 to 150,000) nursing home residents[2526]. Research indicates catheters are often placed for inappropriate indications. [2728]A recent survey (2008) of US hospitals indicated: 56% did not monitor which patients catheterized; 74% did not monitor duration or discontinuation.[29]

Volume of Pathogen in Oregon: We do not have data regarding CAUTI rates for Oregon.

Existence of Evidence-Based Solutions: Evidence-based solutions with high levels of scientific evidence and demonstrated feasibility exist. Core prevention strategies include inserting catheters only for appropriate indicates, leaving catheters in place only as long as needed, and ensuring that properly trained persons insert and maintain catheters.

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[22] Hidron et. Al. Infect Control Hosp Epidemiol. 2008 Nov;29(11):996-1011. Erratum in: Infect Control Hosp Epidemiol. 2009 Jan;30(1):107.

[23] Klevens et. al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002 Pub Health Rep 2007; 2007 Mar-Apr;122(2):160-6.

[24] Jain P. Overuse of the indwelling urinary tract catheter in hospitalized medical patients. Ann Intern Med. 2002 Jul 16;137(2):125-7.

[25] Warren JW et al. The prevalence of urethral catheterization in Maryland nursing homes. Arch Intern Med. 1989 Jul; 149(7):1535-7.

[26] Rogers et al. Use of urinary collection devices in skilled nursing facilities in five states. J Am Geriatr Soc. 2008 May;56(5):854-61.

[27] Beniot et al. Factors associated with antimicrobial use in nursing homes: a multi-level model. J Am Geriatr Soc. 2008 Nov; 56(11):2039-44.

[28] Munasinghe et al. Appropriateness of use of indwelling urinary catheters in patients admitted to the medical service. Ann Intern Med. 2003 Feb 4;138(3):238.

[29] Saint S. Preventing hospital-acquired urinary tract infection in the United States: a national study. Clin Infect. Dis 2008 Jan 15;46(2):251-3.

Healthcare Cost: Costs associated with UTIs are summarized below:[30][31][32][33]

- Excess length of stay of 2 to 4 days.
- Increased cost of $0.4-0.5 billion per year nationally
- Contributes to unnecessary antimicrobial use, which supports the evolution of resistant organisms (ie. HAIs).

Applicability to other care settings: This type of measurement may be applicable to nursing homes.

Barriers to implementation: As most hospitals are reporting this measurement for the CMS Prospective Payment System, barriers are assumed to be low.

[30] Givens CD, Wenzel RP. Catheter-associated urinary tract infections in surgical patients; a controlled study on the excess morbidity and costs. J Urol. 1980 Nov; 124(5):646-8.

[31] Green MS et al. Estimating the effects of nosocomial infections on the length of hospitalization. J Infect Dis. 1982 May; 145 (5): 667-72.

[32] Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Am J Med. Jul 8:1113 Suppl 1A:5S-13S.

[33] Saint S. Clinical and economic consequences of nosocomial catheter-related bacteriuria. Am J Infect Control. 2000 Feb; 28(1); 68-75.

Item F: Composite Measure for HAI for facilities

Current Activity in Oregon: Oregon currently requires hospitals to report six surgical site infections: coronary artery bypass graft (with donor incision), knee prosthesis, hip prosthesis, colon surgery, abdominal hysterectomy, and laminectomy. At the January 2011 meeting, the committee expressed interest in creating a composite measure to represent a given facility's overall infection rate.

Two types of composite measures have been investigated. First, it has been learned that Kaiser Sunnyside uses a commercial data mining service called MedMined which creates a Nosocomial Infection Marker (NIM). MedMined uses artificial intelligence to mine data from the microbiology laboratory to create the NIM. The NIM represents all positive cultures in the hospital; is a proxy measure of infections. Not all infections included in the NIM are infections; some may be patients that are colonized. Several Oregon hospitals have purchased MedMined for their infection control programs.

A second option was to look at the CDC's Standardized Infection Ratio (SIR) to summarize data for a given facility. The SIR compares the infection rate of a given facility to that of a national standard (or expected rate). Currently, the HAI reporting program includes central-line associated bloodstream infections (CLABSIs) in the ICU and surgical site infection reporting for coronary artery bypass graft and knee prosthesis. As of January 1, 2011, hospitals are required to report on four additional procedures: colon, hip replacements, knee replacements, and laminectomy surgeries. Once we have a larger data set from NHSN that may provide a more comprehensive picture of a hospital's performance, this option may be investigated further. Given that the majority of hospitals in the state do not have sufficient information systems to automate upload to the CDC database, it is not feasible at this time to have all hospitals to report a larger volume of infection to NHSN.

Seriousness (Mortality/Morbidity): Not applicable.

Volume of Pathogen in Oregon: Not applicable.

Existence of Evidence-Based Solutions: Not applicable

Healthcare Cost: The use of the MedMined program is a commercial program. Some hospitals have purchased similar software programs, but it cannot be assumed that the algorithm to calculate the composite rate (i.e, the NIM) is the same in different commercial software programs. Installation costs for micro lab data mining software be up to $50,000 and annual maintenance costs can range between $10,000 to $50,000.[34]

[34] Jeanne Negley personal communication with Gerald Iser, Theradoc.com. June 2010.

Applicability to other care settings: Not applicable.

Barriers to implementation: It is not possible to have all hospitals use a commercial software program to calculate a composite infection rate. It is likely not possible that all hospitals can report all infection data using the CDC's National Healthcare Safety Network (NHSN) at this time. When electronic reporting methods improve in hospitals, this proposal may be more feasible.

Item G: Long-Term Care (Nursing Home) Reporting

Current Activity in Oregon: The HAI Reporting Program currently requires long-term care facilities to report urinary tract infections using the CMS reporting system and healthcare worker influenza vaccination rates.

Seriousness (Mortality/Morbidity): During 2010, the Long-Term Care Subcommittee met four times to review options to enhance long-term care HAI reporting. The members agreed that reporting should consist of urinary tract infection and Clostridium difficile events. It was noted that the currently required method of collecting urinary tract infection data using the CMS reporting tool does not distinguish between healthcare acquired and community acquired urinary tract infections. The committee determined it would like to use a system like the National Healthcare Safety Network (NHSN); NHSN has announced it has targeted October 2011 to release a long-term care reporting module with urinary tract and Clostridium difficile infection reporting.

Volume of Pathogen in Oregon: We do not have state data regarding the existence of HAIs in Oregon long-term care facilities.

Existence of Evidence-Based Solutions: As noted in items C and E, evidence-based solutions for Clostridium difficile and urinary tract infections do exist.

Healthcare Costs: There is no cost to use NHSN; it is a free, web-based application. It is unknown if all long-term care facilities have a computer and internet capabilities.

Applicability to other care settings: (Not applicable.)

Barriers to implementation: There is some concern that nursing homes have limited resources and may not be able to report as efficiently as hospitals.

Item H: Ambulatory Surgical Center (ASC) Reporting

Current Activity in Oregon: The current rules for HAI reporting for ASCs consist of conducting survey on evidence-based elements of patient safety performance as defined by Oregon Health Policy and Research.

ASCs have continued to grow both in size and scope. Nationwide, the number of Medicare-certified ASCs grew at an average of 7.3 percent annually between 2000 and 2007.[35] There are two types of ASCs in Oregon: hospital-based, and free-standing. While the number of hospital-based ASCs has remained fairly constant at about 60, the number of free-standing ASCs has increased from 32 in 2000 to 86 in 2011.[36]

Seriousness (Mortality/Morbidity): Because patients in ASCs tended to be healthier than those in hospitals and the procedures performed in ASCs were less invasive and less complex, experts in infection control traditionally have considered the risk of infection in outpatient settings to be low.[37] However, in recent high-profile cases of HAIs in ASCs, large numbers of patients were put at risk and recommended to be tested for healthcare-associated HIV and hepatitis infections. In one such case, approximately 40,000 patients in Nevada were potentially exposed to hepatitis C and other infections disease because of lapses in adherence to basic infection control practices. A recent investigation conducted by the CDC assessed infection control practices of 68 ASCs and found two-thirds had lapses in infection control that included using single-dose medication vials for more than one patient (28.1%), lapses in handling blood glucose monitoring equipment (46.3%). In this study, more than half (57%) of the facilities were cited for deficiencies in infection control practices; this represents six times the deficiencies reported to CMS nationally the year before.) [38]

One of the problems with HAI reporting is that ASCs do not appear to have surveillance and reporting infrastructure found in acute care hospitals. The surgeons that typically practice at an ASC are contracted workers with the ASC and maintain an office off-site from the ASC. As patients follow-up directly with the surgeon, the reporting of post-discharge infections to the ASC is problematic.

Volume of Pathogen in Oregon: unknown.

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[35] A Databook: Healthcare Spending and the Medicate Program, Medicare Payment Advisory Commission, June 2008, Washington, D.C., MedPac.

[36] As of 1/10/2011, from the Oregon Health Licensing Office, Oregon Public Health Division.

[37] C. Friedman et al. "Requirements for Infrastructure and Essential Activities of Infection Control and Epidemiology and Out-of-Hospital Settings: A Consensus Panel Report," American Journal of Infection Control. (27:418-30), 1999.

[38] Schaeffer, M. et al. 2010. Infection Control Assessment of Ambulatory Surgical Centers. JAMA. 2010 Jun 9;303(22):2273-9

Existence of Evidence-Based Solutions: The American Professionals in Infection Control (APIC) are developing a training program for infection control in ASCs, which include training guidelines and best practice checklists.

Healthcare Costs: Unknown.

Applicability to other care settings: Not applicable.

Barriers to implementation: In terms of reporting, Colorado is the only state that is using the National Healthcare Safety Network (NHSN) to report HAI data. Colorado is using NHSN to report hip replacement, knee replacement, and hernia surgeries. In Colorado, ASCs can obtain licensure to have overnight stay suites. Hip and knee replacement surgeries are not performed in Oregon ASCs, as they require overnight stays. There is some concern that some smaller ambulatory surgical centers have limited resources and may not be able to report as efficiently as hospitals.

Item I: Hemodialysis Reporting

Current Activity in Oregon: We do not have reporting rules for hemodialysis facilities in Oregon. The CDC is sponsoring a national collaborative for dialysis centers on infection reduction; some Oregon facilities may be participating in this activity.

Chronic hemodialysis patients are at high risk for infection because the process of hemodialysis requires vascular access for prolonged periods. In an environment where multiple patients receive dialysis concurrently, repeated opportunities exist for person-to-person transmission of infectious agents, directly or indirectly via contaminated devices, equipment and supplies, environmental surfaces, or hands of personnel. Furthermore, hemodialysis patients are immunosuppressed, which increases their susceptibility to infection, and they require frequent hospitalizations and surgery, which increases their opportunities for exposure to infections. The HAIs associated with dialysis patients are antimicrobial resistant organisms.

Seriousness (Mortality/Morbidity): Dialysis patients represent a growing population (approximately 355,000). By 2020, it is projected that the population of end stage renal disease (ESRD) patients will increase by 42%.[39] Infections are the second cause of death for ESD patients, most commonly at the vascular access site.

The Northwest End Stage Renal Network posts data for Oregon ESRD patients as follows:

- Mortality for all patients (percent of deaths due to infection): **17%** (2006-2009 average)
- First year mortality (percent of deaths due to infection): **24%** (2006-2009 average)

Volume of Pathogen in Oregon: not applicable.

Existence of Evidence-Based Solutions: CDC is developing recommended guidelines that include chlorhexidine for skin antisepsis during catheter insertion and dressing changes, hand hygiene audits, catheter care and access care, patient education and engagement, staff education and competency, and catheter reduction.

Healthcare Costs: The costs for infections associated with dialysis patients is unknown. Medicare is the largest payer of outpatient dialysis services, and total US costs for 2008 were approximately $7.8 billion[40]. As noted above, dialysis patients are frequently admitted to the hospital.

---

[39] US Renal Data System (USRDS) 2010 Annual Data Report.

[40] A Data Book. Health Spending, the Medicare Program. MedPac. http://www.medpac.gov/documents/Jun10DataBookEntireReport.pdf. Accessed 4/7/2011.

Cause-specific hospitalization rates among hemodialysis patients for 2006 include:

Vascular access infection = ~125 admissions/1000 pt-yrs

Bloodstream infection = ~103 admissions/1000 pt-yrs

Pnemonia = 76 admissions/1000 pt yrs

Applicability to other care settings: Not applicable.

Barriers to implementation: Until recently, a national surveillance program for dialysis centers was unknown. National Healthcare Safety Network (NHSN) has a new module to facilitate reporting of bloodstream infections. It is currently in use by Colorado and about 130 facilities nationwide. It is similar to the CLABSI reporting module for hospitals and it includes reporting of monthly census data on vascular access type (graft, fistula, temporary central line, permanent central line, port access device). As it is a new system, it is unknown if it provides useful data for reporting.

To be completed every month

MDRO and CDAD Prevention Process and Outcome Measures Monthly Monitoring

OMB No. 0920-0666
Exp. Date: 09-30-2012

*required for saving **conditionally required based upon monitoring selection in Monthly Reporting Plan

Facility ID #: _____ *Month:_____ *Year:_____ *Location Code:_____

Setting: Inpatient **Total Days§:_____ ** Total Admissions§: _____
Setting: Outpatient (or Emergency Room) **Total Encounters§:_____

If FACWIDE includes *C. difficile* (omit NICU & Well baby)
***C. diff* Days: _____** *C. diff* Admissions:_____**C. diff* Encounters:_____

MDRO & CDAD Infection Surveillance or LabID Event Reporting					
(Specific Organism Type)	MRSA	VRE	MDR-*Klebsiella*	MDR-*Acinetobacter*	*C. difficile*
Infection Surveillance	☐	☐	☐	☐	☒
LabID Event (All)	☐	☐	☐	☐	☐
LabID Event (Blood specimens only)	☐	☐	☐	☐	

Process Measures (Optional)

Hand Hygiene
** Performed:_____ ** Indicated:_____

Gown and Gloves
** Used:_____ ** Indicated:_____

Active Surveillance Testing (AST)					
**Active Surveillance Testing performed	☐	☐			
**Timing of AST † (circle one)	**Adm Both**	**Adm Both**			
**AST Eligible Patients ‡ (circle one)	**All NHx**	**All NHx**			
Admission AST					
** Performed					
** Eligible					
Discharge/Transfer AST					
** Performed					
** Eligible					

Optional

Assurance of Confidentiality: The information obtained in this surveillance system that would permit identification of any individual or institution is collected with a guarantee that it will be held in strict confidence, will be used only for the purposes stated, and will not otherwise be disclosed or released without the consent of the individual, or the institution in accordance with Sections 304, 306 and 308(d) of the Public Health Service Act (42 USC 242b, 242k, and 242m(d)).

To be completed for each infection

Laboratory-identified MDRO or CDAD Event

OMB No. 0920-0666
Exp. Date: 09-30-2012

*required for saving Facility ID:		Event #:
*Patient ID:		Social Security #:
Secondary ID:		
Patient Name, Last:	First:	Middle:
*Gender: M F	*Date of Birth:	
Ethnicity (Specify):	Race (Specify):	

Event Details

*Event Type: LabID	*Date Specimen Collected:	
*Specific Organism Type: (Check one) ☐ MRSA ☐ MSSA ☐ VRE ☐ MDR-*Klebsiella* ☐ MDR-*Acinetobacter* ☐ *C. difficile*		
*Outpatient: Yes No	*Specimen Body Site/System:	*Specimen Source:
*Date Admitted to Facility:	*Location:	*Date Admitted to Location:
*Has patient been discharged from your facility in the past 3 months? Yes No		
If Yes, date of last discharge from your facility:		

Custom Fields

Label		Label	
_____	___/___/___	_____	___/___/___
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Comments

MDRO and CDAD Prevention Process and Outcome Measures Monthly Monitoring

OMB No. 0920-0666
Exp. Date: 09-30-2012

Outcome Measures (Optional)

Prevalent Cases

(Specific Organism Type)	MRSA	VRE	MDR-*Klebsiella*	MDR -*Acinetobacter*	*C.difficile*
** AST/Clinical Positive					
** Known Positive					
Incident Cases:					
** AST/Clinical Positive					

Optional

Custom Fields

Label _____ _____ _____ _____ _____

Data _____ _____ _____ _____

Optional

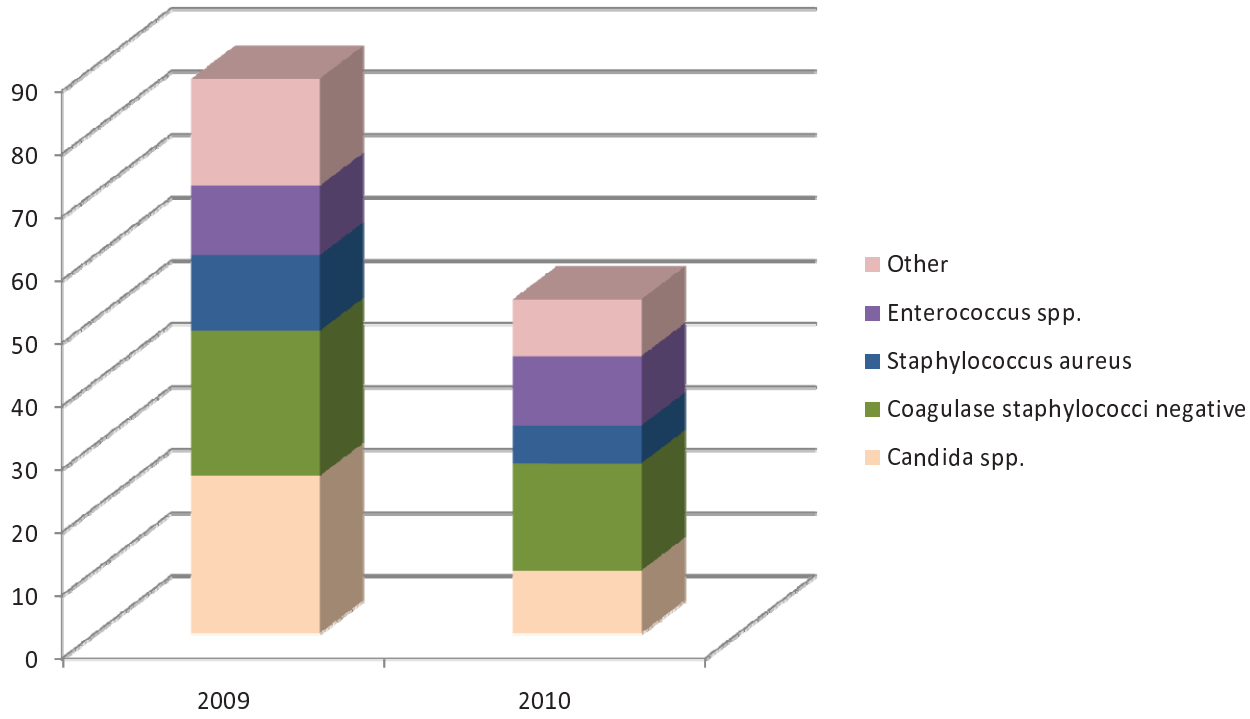
§ If Location Code = FACWIDEIN and Organism= *C. difficile,* exclude NICU & Well Baby Nurseries from Total Patient Days and Total Admissions.

If Location Code = FACWIDEOUT and Organism = *C. difficile,* exclude Well Baby Clinics from Total Encounters

† Adm – Admission testing **Both** – Admission and Discharge/Transfer testing

‡ All – All patients tested **NHx** – Only patients tested are those who have no documentation at the admitting facility in the previous 12 months of MDRO-colonization or infection at the time of admission

Microorganisms Associated with Central Line Associated Blood Stream Infections (CLABSIs) in Medical/Surgical Intensive Care Units, Oregon, 2009 (n=88) and 2010 (n=53)

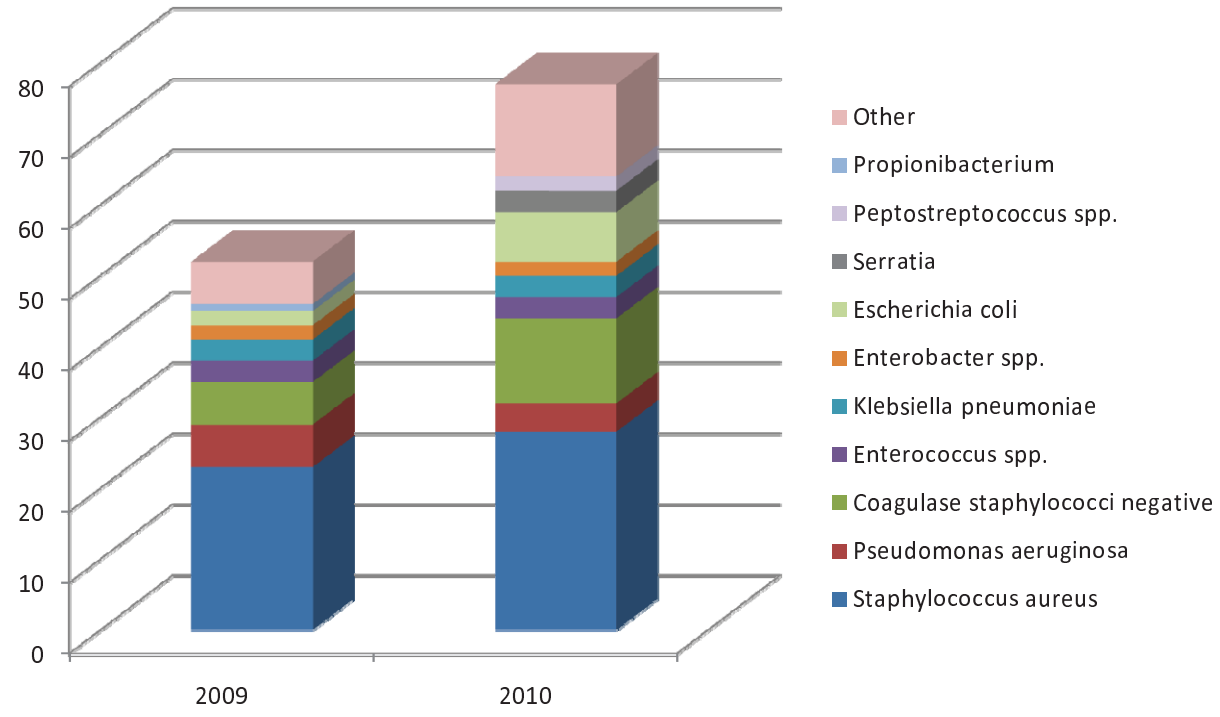


	2009		2010	
Candida spp.	25	28%	10	19%
Coagulase staphylococci negative	23	26%	17	32%
Staphylococcus aureus	12	14%	6	11%
MRSA	*3*	*3%*	*4*	*8%*
Enterococcus spp.	11	13%	11	21%
VRE	*4*	*5%*	*1*	*2%*
Other	17	19%	9	17%

Other category includes:

	2009		2010	
Acinetobacter	1	1%	0	0%
Bacteroides fragilis	1	1%	0	0%
Citrobacter amalonaticus	0	0%	1	2%
Enterobacter spp.	4	5%	2	4%
Escherichia coli	3	3%	2	4%
Gram-positive rod unspecified	0	0%	1	2%
Klebsiella pneumoniae	2	2%	2	4%
Moraxella spp.	1	1%	0	0%
Pseudomonas spp.	1	1%	0	0%
Serratia	2	2%	0	0%
Stenotrophomonas maltophilia	1	1%	0	0%
Yeast	1	1%	1	2%

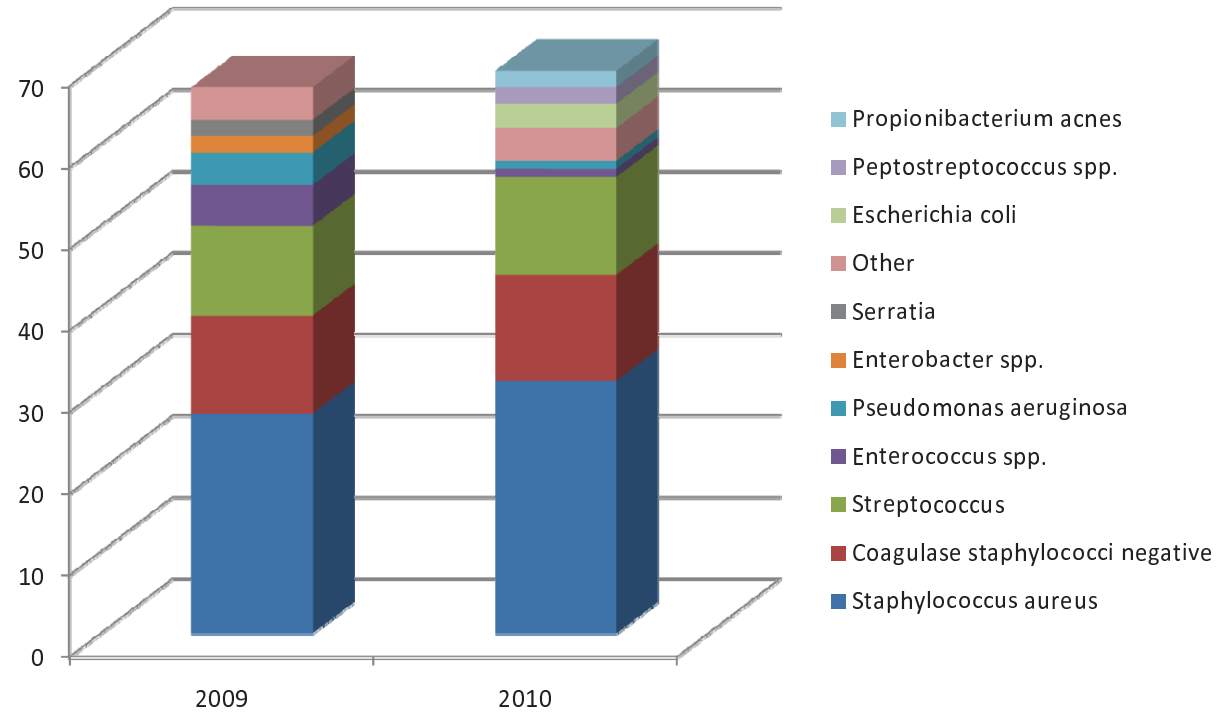
Microorganisms Associated with Coronary Artery Bypass Graft (CABG) Surgical Site Infections, Oregon, 2009 (n = 51) and 2010 (n=77)



	2009		2010	
Staphylococcus aureus	23	45%	28	36%
MRSA	*8*	*16%*	*6*	*8%*
Pseudomonas aeruginosa	6	12%	4	5%
Coagulase staphylococci negative	6	12%	12	16%
Enterococcus spp.	3	6%	4	5%
VRE	*0*	*0%*	*1*	*1%*
Klebsiella pneumoniae	3	6%	3	4%
Serratia	0	0%	3	4%
Enterobacter spp.	2	4%	2	3%
Escherichia coli	2	4%	7	9%
Peptostreptococcus spp.	0	0%	2	3%
Propionibacterium	1	2%	0	0%
Other	5	10%	12	16%

Other category includes:	2009		2010	
Anaerobe - NOS	0	0%	1	1%
Bacillus spp.	1	2%	0	0%
Bacteroides fragilis	0	0%	1	1%
Candida albicans	0	0%	2	3%
Citrobacter koseri	0	0%	1	1%
Corynebacterium spp.	0	0%	1	1%
Morganella	1	2%	1	1%
Proteus mirabilis	0	0%	2	3%
Staph coagulase positive	0	0%	2	3%
Stenotrophomonas maltophilia	1	2%	0	0%
Streptococcus	1	2%	0	0%
Yeast	1	2%	1	1%

Microorganisms Associated with Knee Replacements (KPRO)
Surgical Site Infections 2009 (n = 67) and 2010 (n = 69)



	2009		2010	
Staphylococcus aureus	27	40%	31	45%
MRSA	*6*	*9%*	*6*	*9%*
Coagulase staphylococci negative	12	18%	13	19%
Streptococcus	11	16%	12	17%
Enterococcus spp.	5	7%	1	1%
VRE	*0*	*0%*	*0*	*0%*
Pseudomonas aeruginosa	4	6%	1	1%
Enterobacter spp.	2	3%	0	0%
Serratia	2	3%	0	0%
Escherichia coli	0	0%	3	4%
Peptostreptococcus spp.	0	0%	2	3%
Propionibacterium acnes	0	0%	2	3%
Other	4	6%	4	6%

Other category includes:

	2009		2010	
Anaerococcus	0	0%	1	1%
Clostridium perfringens	1	1%	1	1%
Corynebacterium spp.	1	1%	0	0%
Escherichia coli	1	1%	0	0%
Gram-positive cocci unspecified	1	1%	1	1%
Staphylococcus intermedius	0	0%	1	1%

Washington DC Rules re MRSA Surveillance

2038 MRSA INFECTION PREVENTION

2038.1 Each hospital shall have written infection prevention and control policies and procedures.

2038.2 Each hospital shall identify MRSA colonized patients in an intensive care unit or other at-risk unit.

2038.3 Each patient colonized or infected with MRSA shall be isolated in an appropriate manner consistent with guidelines for best practices. A patient in a long-term care facility who is infected or colonized shall be permitted to participate in group activities provided that any draining wounds are covered, bodily fluids are contained, and the patient is observed to have proper hygiene practices.

2038.4 Each hospital shall adhere to hand hygiene best practices to ensure, through education and monitoring, that healthcare personnel properly cleanse hands between patient care activities.

2038.5 Each hospital shall monitor trends in the incidence of MRSA in the hospital over time and enhance infection control interventions if rates do not decrease.

2038.6 Each hospital shall maintain a mechanism for identifying a MRSA patient who is readmitted to the hospital (i.e. flagging).

2038.7 Each hospital shall have a worker education requirement regarding modes of transmission, use of personal protective equipment, disinfection policies and procedures, and other preventive measures in accordance with current CDC guidelines on the use of "Standard Precautions" and "Transmission-Based Precautions".

2038.99 When used in this section, the following terms shall have the meanings ascribed:

Colonized - having a bacterial organism present on or in the body that is not causing illness.

Long-term care facility - a component of a hospital intended for the treatment of patients who require extended stays in a hospital setting to complete their treatment.

Methicillin-resistant staphylococcus aureus (MRSA) - a bacterium that is resistant to antibiotics known as beta-lactams. These antibiotics include methicillin, amoxicillin, oxacillin, and penicillin.

SOURCE: Notice of Final Rulemaking published at 56 DCR 848 (January 23, 2009).

California State Statute re MRSA Surveillance

CA SB 1058, Chapter 296

(5) "MRSA" means Methicillin-resistant Staphylococcus aureus.

(b) (1) Each patient who is admitted to a health facility shall be tested for MRSA in the following cases, within 24 hours of admission:

(A) The patient is scheduled for inpatient surgery and has a documented medical condition making the patient susceptible to infection, based either upon federal Centers for Disease Control and Prevention findings or the recommendations of the committee or its successor.

(B) It has been documented that the patient has been previously discharged from a general acute

care hospital within 30 days prior to the current hospital admission.
(C) The patient will be admitted to an intensive care unit or burn unit of the hospital.
(D) The patient receives inpatient dialysis treatment.
(E) The patient is being transferred from a skilled nursing facility.
(2) The department may interpret this subdivision to take into account the recommendations of the federal Centers for Disease Control and Prevention, or recommendations of the committee or its successor.
(3) If a patient tests positive for MRSA, the attending physician shall inform the patient or the patient's representative immediately or as soon as practically possible.
(4) A patient who tests positive for MRSA infection shall, prior to discharge, receive oral and written instruction regarding aftercare and precautions to prevent the spread of the infection to others.
(c) Commencing January 1, 2011, a patient tested in accordance with subdivision (b) and who shows evidence of increased risk of invasive MRSA shall again be tested for MRSA immediately prior to discharge from the facility. This subdivision shall not apply to a patient who has tested positive for MRSA infection or colonization upon entering the facility.
(d) A patient who is tested pursuant to subdivision (c) and who tests positive for MRSA infection shall receive oral and written instructions regarding aftercare and precautions to prevent the spread of the infection to others.
(e) The infection control policy required pursuant to Section 70739 of Title 22 of the California Code of Regulations, at a minimum, shall include all of the following:
(1) Procedures to reduce health care associated infections.
(2) Regular disinfection of all restrooms, countertops, furniture, televisions, telephones, bedding, office equipment, and surfaces in patient rooms, nursing stations, and storage units.
(3) Regular removal of accumulations of bodily fluids and intravenous substances, and cleaning and disinfection of all movable medical equipment, including point-of-care testing devices such as glucometers, and transportable medical devices.
(4) Regular cleaning and disinfection of all surfaces in common areas in the facility such as elevators, meeting rooms, and lounges.
(f) Each facility shall designate an infection control officer who, in conjunction with the hospital infection control committee, shall ensure implementation of the testing and reporting provisions of this section and other hospital infection control efforts. The reports shall be presented to the appropriate committee within the facility for review. The name of the infection control officer shall be made publicly available, upon request.

Hospital MRSA Active Surveillance Practices in Non-Outbreak Settings

1.

*** 1. Please complete the following contact information (in the company field please enter your facility name and title):**

Name:	
Company:	
Email Address:	
Phone Number:	

*** 2. Is your facility currently performing active surveillance for MRSA?**

- ◯ Yes
- ◯ No

2.

*** 3. In non-outbreak settings, what type of MRSA surveillance does your facility perform?**

- ◯ Universal surveillance (all patients)
- ◯ Targeted surveillance (select patients)
- ◯ Both (please specify)

3.

*** 4. What are the criteria your facility uses for MRSA targeted surveillance? Please check all that apply.**

- [ ] Hospitalized in ICU
- [ ] Transfer from all long term care facilities
- [ ] Transfer from specific long term care facilities
- [ ] Transfer from other acute care facility
- [ ] History of homelessness
- [ ] Current homelessness
- [ ] History of incarceration
- [ ] Current incarceration
- [ ] Presence of skin/wound infection
- [ ] History of MRSA colonization/infection
- [ ] Prior hospitalizations (within previous 12 months)
- [ ] History of dialysis (within previous 12 months)
- [ ] Presence of bladder catheter
- [ ] Presence of intravenous catheter
- [ ] Injection drug user
- [ ] Household/close contact with any person with any of the above
- [ ] Other (please specify)

4.

*** 5. In non-outbreak settings, when is MRSA active surveillance performed? Please check all that apply.**

- [ ] Admission
- [ ] Transfer to different unit within the facility
- [ ] Discharge

Hospital MRSA Active Surveillance Practices in Non-Outbreak Settings

*** 6. In non-outbreak settings, what types of specimens and/or from what sites do you collect specimens for MRSA active surveillance? Please check all that apply.**

- [ ] Anterior Nares
- [ ] Throat
- [ ] Perineal/Perirectal
- [ ] Axilla
- [ ] Non-intact Skin Surfaces (wound, decubitus, rash, etc)
- [ ] Skin/Tube Interfaces
- [ ] Endotracheal Aspirate
- [ ] Sputum
- [ ] Blood
- [ ] Urine
- [ ] Stool
- [ ] Other (please specify)

7. Which of the follow methods does your facility routinely use on patient specimens in actively surveying for MRSA?

- [ ] Screening cultures (solid agar, liquid media, ...)
- [ ] Molecular methods (PCR, PFGE, ...)
- [ ] Both

5.

*** 8. Which types of screening culture does your facility use? Please check all that apply.**

- [ ] Mannitol salt agar (MSA)
- [ ] Oxacillin resistance screening agar (ORSAB)
- [ ] Baird Parker medium with ciprofloxacin (BPC)
- [ ] Desferrioxamine together with oxacillin, tellurite and egg yolk in a mannitol salt agar base (DOTEMSA)
- [ ] Desferrioxamine together with amphotericin B, polymyxin B and oxacillin in a Columbia agar base (CODAP)
- [ ] Chromogenic agars (CHROMagar)
- [ ] Other (please specify)

9. How long before your facility gets the results of the MRSA active surveillance screening cultures?

*** 10. Subsequent to the culture screening method, what types of biochemical identification does your laboratory regularly perform on culture isolates? Please check all that apply.**

- [ ] Does not regularly perform biochemical identification
- [ ] PCR
- [ ] PFGE
- [ ] Virtual PFGE (Diversilab System)
- [ ] Other (please specify)

6.

11. How long before the MRSA active surveillance biochemical identification results are available?

7.

*** 12. Which types of molecular methods are used directly on patient specimens? Please check all that apply.**

- [ ] PCR
- [ ] PFGE
- [ ] Virtual PFGE (Diversilab System)
- [ ] Other (please specify)

13. How long before the MRSA active surveillance molecular analysis results are available?

8.

*** 14. Who is responsible for actions taken after MRSA active surveillance results are available?**

- [ ] Patient's physician
- [ ] Charge nurse
- [ ] Infection control professional
- [ ] Infectious disease physician
- [ ] Other (please specify)

*** 15. If patients are positive on MRSA active surveillance, do you attempt to decolonize?**

- ◯ Yes
- ◯ No
- ◯ Depends on patient characteristics

9.

16. If decision to decolonize is dependent on patient characteristics, which of the following patients would you decolonize? Please check all that apply.

- [ ] Cardiac surgery patients
- [ ] Recent C-section
- [ ] Solid organ transplant patients
- [ ] Bone-marrow transplant patients
- [ ] Burn patients
- [ ] History of recurrent MRSA infections
- [ ] Other (please specify)

10.

*** 17. How are patients decolonized? Please check all that apply.**

- [ ] Intranasal mupirocin
- [ ] Chlorohexidine wash
- [ ] Oral/IV antibiotics
- [ ] Other (please specify)

11.

*** 18. In non-outbreak settings, are patients routinely kept in any of the following environments prior to results of MRSA active surveillance? Please check all that apply.**

- [ ] Contact precautions
- [ ] Private room
- [ ] Cohort
- [ ] Standard precautions
- [ ] None
- [ ] Other (please specify)

*** 19. If patients are positive on active surveillance, what actions are taken? Please check all that apply.**

- [ ] Contact precautions
- [ ] Cohort
- [ ] Private room
- [ ] Hand hygiene messages
- [ ] Standard precautions
- [ ] None
- [ ] Other (please specify)

*** 20. Are patients and/or family members made aware of test result?**

- ◯ Yes
- ◯ No

Additional Comment

*** 21. What instructions are given to colonized patients upon discharge to home? Please check all that apply.**

- ☐ Verbal instructions/education
- ☐ Written educational materials
- ☐ Referral to primary care physician
- ☐ Personal Protective Equipment (PPE) for household/close contacts
- ☐ Other (please specify)

*** 22. What instructions are given to colonized patients and/or receiving facility upon discharge to a Skilled Nursing Facility? Please check all that apply.**

- ☐ Verbal instruction/education
- ☐ Written educational materials
- ☐ Referral to primary care physician
- ☐ PPE for household/close contacts
- ☐ Disclosure of culture status
- ☐ Contact isolation
- ☐ Other (please specify)

*** 23. Why is your facility performing MRSA active surveillance?**

- [ ] Concern that hospital will not be reimbursed for hospital acquired infection associated costs
- [ ] Prevention of MRSA transmission
- [ ] Determine incidence and prevalence of healthcare associated versus community associated infections of MRSA in facility
- [ ] Reduce rates of MRSA in facility
- [ ] Other (please specify)

*** 24. Is there an evaluation process to assess your MRSA active surveillance system?**

- ◯ Yes
- ◯ No

12.

*** 25. Please explain briefly the evaluation plan of your MRSA active surveillance system.**

13.

Hospital MRSA Active Surveillance Practices in Non-Outbreak Settings

*** 26. In non-outbreak settings, which other organisms does your facility actively survey for? Please check all that apply.**

- [ ] Methicillin-sensitive Staphylococcus aureus
- [ ] RSV
- [ ] Influenza A
- [ ] Influenza B
- [ ] Respiratory Virus Panel
- [ ] Pseudomonas spp.
- [ ] Klebsiella pneumoniae
- [ ] Acinetobacter spp.
- [ ] Multi-drug Resistant Gram-negative Rods
- [ ] Vancomycin-resistant enterococcus
- [ ] Clostridium difficile
- [ ] Other (please list all other)

14.

*** 27. If your facility is currently not performing MRSA active surveillance, has there been any internal discussion to do so?**

- ◯ Yes
- ◯ No

15.

*** 28. Please describe current discussions at your facility regarding implementing MRSA active surveillance.**

16.

Thank you for completing this survey.

29. Would you like to receive a de-identified summary of the results of this questionnaire?

- ◯ Yes
- ◯ No

Overview of MRSA Surveillance in Oregon

Jamie Thompson, MPH
ABCs Surveillance Officer

HAI Advisory Committee Meeting
April 13, 2011

Background

- Part of Active Bacterial Surveillance (ABCs) program
  - Core component of CDC's Emerging Infections Program network (EIP)
  - Active laboratory- and population-based surveillance system for invasive bacterial pathogens of public health importance
    - MRSA (methicillin-resistant *Staphylococcus aureus*) – *Started in 2004*
    - Group A and Group B *Streptococcus*
    - *Haemophilus influenzae*
    - *Neisseria meningitidis*
    - *Streptococcus pneumoniae*
    - *Legionella*
  - Provides infrastructure for tracking disease trends and conducting special studies

MRSA Case Definition

- All residents in the Tri-County area (Clackamas, Multnomah, Washington) from whom MRSA has been isolated from a normally sterile site
  - Sterile
    - Blood, CSF, pleural fluid, pericardial fluid, peritoneal fluid, joint/synovial fluid, bone, internal body site (brain, heart, liver, etc.), muscle, internal body abscess, deep tissues removed surgically
  - Non-sterile
    - Skin, wound, swabs, sputum, urine, sinus, throat, eye, ear

Participating Hospital Labs

- Six clinical laboratories provide microbiology services to 13 hospitals within our catchment area
  - Adventist
  - Kaiser
    - Kaiser Sunnyside, OHSU
  - Legacy
    - Emanuel, Good Samaritan, Meridian Park, Mount Hood
  - Providence
    - Milwaukie, Portland, St. Vincent, Willamette Falls
  - Tuality
  - VA

Surveillance Methodology

Case Ascertainment → **Medical Chart Review**

1. Tri-county hospital labs submit MRSA isolates obtained from normally sterile sites to OSPHL
   a. Isolates forwarded to CDC for further testing
2. Additional cases identified through routine lab report reviews

1. Confirm case has MRSA isolated from a normally sterile site
2. Complete case report form

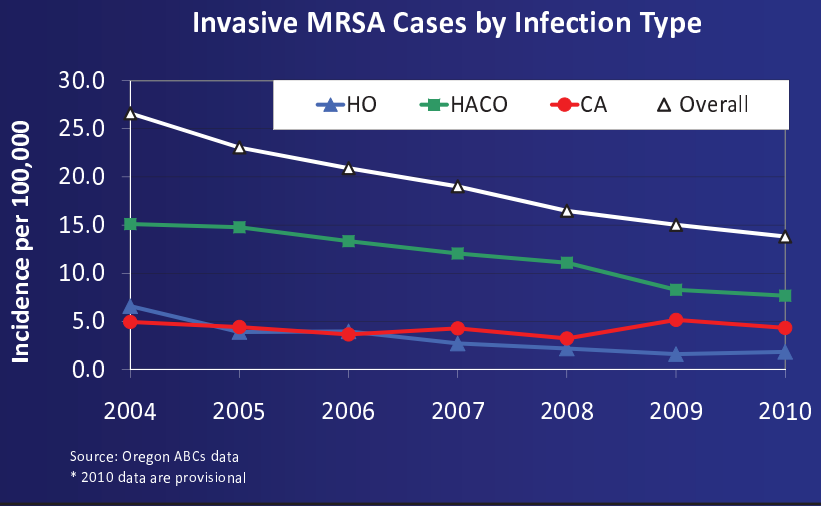
Case Report Form

- Demographics
- Clinical information
  - Hospitalization, patient outcome, MRSA infection(s) associated with culture
- Underlying conditions / risk factors
  - Diabetes, congestive heart failure, chronic renal insufficiency
- Epidemiological classification
  - Healthcare-associated and community-associated

Epidemiological Classifications

- Hospital-onset (HO-)
  - MRSA infection identified more than 2 days after hospital admission
- Healthcare-associated, community-onset (HACO-)
  - MRSA infection identified within 2 days after hospital admission and had one or more of the following: 1) a history of hospitalization, surgery, dialysis, or residence in a long term care facility in the previous year, or 2) the presence of a central vascular catheter <=2 calendar days prior to collection of initial culture
- Community-associated (CA-)
  - None of the previously mentioned criteria are met

Incidence



Contact

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- Publications
  - Oregon
    - http://public.health.oregon.gov/DiseasesConditions/DiseasesAZ/Documents/mrsa/mrsa08.pdf
  - CDC ABCs MRSA report
    - http://www.cdc.gov/abcs/reports-findings/survreports/mrsa08.html

New York State Department of Health: Mandatory Reporting of *Clostridium difficile* via National Healthcare Safety Network LabID Event – Audit Results

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Diana Doughty, RN, MBA, CIC, CPHQ, Peggy Hazamy, RN, BSN, CIC, Rachel Stricof, MPH, CIC,
Marie Tsivitis, MPH, CIC, Victor Tucci, MPH, CIC, ASCP, Carole Van Antwerpen, RN, BSN, CIC

New York State Dept. of Health, HAI Reporting Program

Abstract

Background
In July 2009, New York State (NYS) began using the National Healthcare Safety Network (NHSN) LabID Event module to report facility-wide *Clostridium difficile* (*C. diff*) at all NYS hospitals as part of the mandatory public reporting law. NYS staff performs annual on-site audits to ensure the accuracy of the data submitted by hospitals.

Objectives
Analyze the accuracy of the overall number of *C. diff* events reported to the NHSN. Determine effect of data entry errors on the case status (CO – community onset; CO-HCFA – community onset-healthcare facility associated; HO – hospital onset) assigned to these events.

Methods
Of the 179 NYS hospitals mandated to report, 179 (100%) entered 2009 facility-wide *C. diff* LabID Event data into the NHSN. NYS staff audited a sample of data from 93 (52%) of these facilities for accuracy and completeness. A standardized process (Figure 1) was used to ensure consistent implementation by HAI reviewers in all hospitals. Data was extracted from the NHSN for each hospital and compared to lab generated data.

Results
(Table 1) Of the 3365 lab reports that were examined, reviewers identified an additional 235 infections that should have been reported to the NHSN, an underreporting of 7.0% in the sample. Over reporting was identified in 63 (1.9%) events. Discrepancies were identified in 259 (8.6%) specimen dates, 99 (3.3%) admission dates, and 213 (8.2%) last discharge dates.
(Table 2) The overall case status match was 96.9% (2991/3088). An additional 50 (1.7%) events, previously classified as CO, were changed to CO-HCFA or HO events after audit. Conversely, 19 (0.6%) events, previously classified as CO-HCFA or HO, were changed to CO events after audit.

Conclusions
The audits revealed an incidence of 7% underreporting caused mainly by misunderstanding of the reporting requirements, or miscommunication between the laboratory and the Infection Prevention staff.
Despite all *C. diff* LabID Event data being manually entered into the NHSN, NYS hospitals are very accurate with data entry. There were a total of 571 (6.6%) date discrepancies identified that may have affected case status assignment in NHSN; this resulted in only 97 (3.1%) changes in case status among the events reviewed.
Moving forward, increased data accuracy could be accomplished by allowing facilities to import their data; electronic surveillance may also eliminate most of the underreporting and will be important as mandatory reporting requirements continue to increase.

Acronyms and Definitions

National Healthcare Safety Network (NHSN) Case Status

- CO = Community onset (specimen collected ≤ day 3 of admission and patient was not discharged from facility within 4 weeks)
- CO-HCFA = Community onset-healthcare facility associated (specimen collected ≤ day 3 of admission and patient was discharged from facility within 4 weeks)
- HO = Hospital Onset (specimen collected ≥ day 4 of admission)

Methods

Of the 179 NYS hospitals mandated to report, 179 (100%) entered 2009 facility-wide *C. diff* LabID Event data into the NHSN. Between October 2009 and May 2010, NYS HAI Reporting Program staff – certified Infection Preventionists and trained research staff – conducted on-site audits at 93 (52%) of these facilities to assess July-December 2009 data accuracy and completeness.

Prior to the visit, facilities were asked to provide a laboratory line list of all positive *C. diff* specimens for a certain time period. Information reported into the NHSN for the same reporting period was exported into an Excel spreadsheet. The two sources of data were then compared during the on-site visit. (Figure 1) The standardized process was used to ensure consistent implementation by HAI reviewers in all hospitals.

Any identified discrepancies were discussed with the facility's Infection Preventionist to ensure that any systematic issues were addressed immediately.

Tables & Figures

Figure 1: *C. diff* Audit Tool

Spec Date	Agree	Should be	Adm Date	Agree	Should be	Prev d/c date	Agree	Should be
08/12/09	No	08/10/09	08/01/09	Yes		06/25/09	Yes	
10/01/09	Yes		10/01/09	Yes		Blank	No	09/15/09

Table 1: *C. diff* Event – Data Entry Discrepancies

	# of Differences	# Events Reviewed	% Difference
Specimen Date	259	3026	8.6
Admission Date	99	3008	3.3
Prev Discharge Date	213	2609	8.2
Underreported	235	3365	7.0
Over reported	63	3365	1.9

Table 2: *C. diff* Event – Case Status Match

Hospital	Reviewer			
	CO (Community Onset)	CO-HCFA (CO-Healthcare Facility Associated)	HO (Hospital Onset)	Overall Match
CO	799 (25.9%)	24	26	
CO-HCFA	6	482 (15.6%)	15	
HO	13	13	1710 (55.4%)	
Overall Match				2991 (96.9%)

Results

- 93 (52%) of the 179 reporting hospitals had an on-site audit of their July-December 2009 *C. difficile* LabID Event data.

Of the 3365 lab reports that were examined, reviewers identified an additional 235 infections that should have been reported to the NHSN, an underreporting of 7.0% in the sample.
Over reporting was identified in 63 (1.9%) events. (Table 1)

Discrepancies were identified in 259 (8.6%) specimen dates, 99 (3.3%) admission dates, and 213 (8.2%) last discharge dates. (Table 1)

- These discrepancies resulted in 97 (3.1%) changes in case status among the events reviewed. (Table 2)

The overall case status match was 96.9% (2991/3088). (Table 2)
An additional 50 (1.7%) events, previously classified as CO, were changed to CO-HCFA or HO events after audit.
Conversely, 19 (0.6%) events, previously classified as CO-HCFA or HO, were changed to CO events after audit.

More than half of the *C. diff* cases identified were considered HO by the NHSN. (Table 2)

- No regional differences were detected.

Conclusions

The audits revealed an incidence of 7% underreporting and 2% over reporting, both caused mainly by misunderstanding of the reporting requirements, or miscommunication between the laboratory and the Infection Prevention staff.

Despite all *C. diff* LabID Event data being manually entered into the NHSN, NYS hospitals are very accurate with data entry.

Moving forward, increased data accuracy could be accomplished by allowing facilities to import their data; electronic surveillance may also eliminate most of the underreporting and will be important as mandatory reporting requirements continue to increase.

The start of this audit process was delayed due to a 60-day lag in facilities reporting data into the NHSN. Moving forward a larger proportion of hospitals will be audited yearly.

Note: The 2007-2009 New York State Hospital-Acquired Infection Reports can be found at:
www.nyhealth.gov/nysdoh/hospital/reports/hospital_acquired_infections.
The 2010 Report is expected to be released September 2011.

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Methicillin-Resistant *Staphylococcus aureus* (MRSA) Surveillance Report 2008

Oregon Active Bacterial Core Surveillance (ABCs)
Office of Disease Prevention & Epidemiology
Oregon Department of Human Services
Updated: March 2010

Background

Active Bacterial Core surveillance (ABCs) is a core component of the Emerging Infections Program (EIP) Network sponsored by the Centers for Disease Control and Prevention (CDC). The purpose of the ABCs program is to determine the incidence and epidemiologic characteristics of invasive disease due to *Haemophilus influenzae*, *Neisseria meningitidis*, group A *Streptococcus* (GAS), group B *Streptococcus* (GBS), *Streptococcus pneumoniae*, and methicillin-resistant *Staphylococcus aureus* (MRSA). The entire EIP Network represents over 38 million persons in 10 surveillance areas around the United States. More information on the EIP/ABCs Network is found at: http://www.cdc.gov/abcs/index.html.

In Oregon, the surveillance area for MRSA comprises the tri-county (Clackamas, Multnomah, and Washington) Portland metropolitan area with a 2008 estimated population of 1,614,465. More information on the Oregon ABCs program is found at: http://oregon.gov/DHS/ph/acd/abc.shtml.

Methods

An invasive MRSA infection* is defined as the isolation of MRSA from a normally sterile body site in a tri-county resident. Tri-county hospital laboratories submit MRSA isolates to the Oregon State Public Health Laboratory (OSPHL) for identification. The OSPHL forwards a subset of these isolates to a CDC laboratory for further characterization and antimicrobial susceptibility testing. Additional cases are identified through regular laboratory record reviews. Health record reviews of each case allow standardized reports of demographic characteristics, clinical syndrome manifestations, underlying conditions and diseases, healthcare-associated risk factors, and illness outcome.

Cases are classified based on the presence of established healthcare risk factors and time of culture collection in relation to hospital admission. Healthcare-onset (HO-) MRSA infections are those in which the initial culture was collected >48 hours after hospital admission; healthcare-associated, community-onset (HACO-) MRSA cases are those in which the initial culture was collected ≤48 hours after hospital admission or evaluation and the medical chart indicates one or more of the following risk factors: previous MRSA colonization or infection, presence of an invasive device or catheter at the time of admission or evaluation, or hospitalization, surgery, dialysis, or resident of a long-term care facility (LTCF) within the year preceding the index culture date; and community-associated (CA-) MRSA cases are those in which the initial culture was collected ≤48 hours after hospital admission or evaluation and none of the above risk factors are noted in the medical record.

Additional technical information on surveillance methodology, including data elements collected, healthcare risk factors, clinical manifestations, and underlying diseases and conditions can be found at the EIP/ABCs Network website listed above.

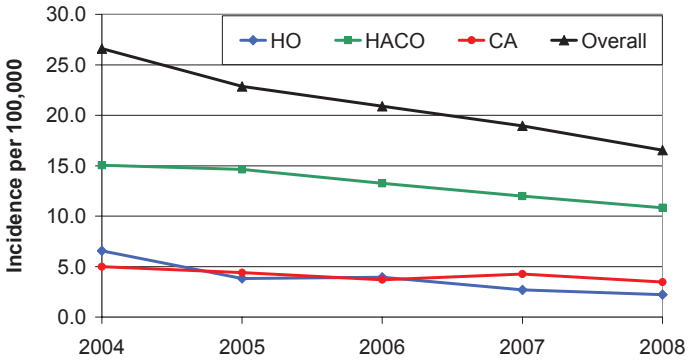
* MRSA *infection* is the invasion of bacteria in the tissues of the host leading to clinical signs and symptoms of illness or infection whereas *colonization* refers to the presence of bacteria but without tissue damage and signs of illness or infection. Colonized patients are also known as asymptomatic carriers.

Surveillance Results

Descriptive Epidemiology

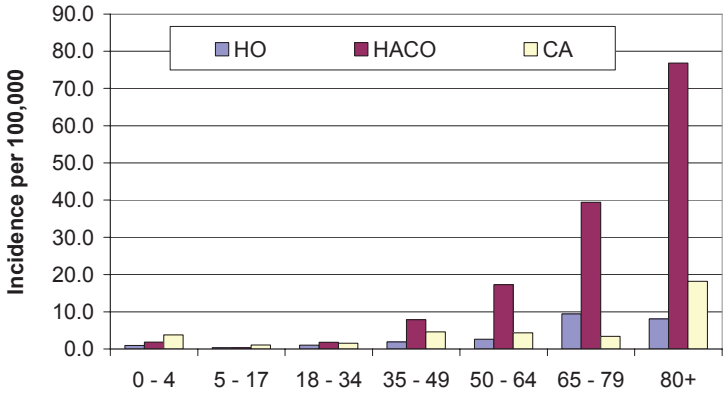
In 2008, we identified 267 cases of invasive MRSA disease for an overall incidence of 16.5/100,000 persons (Figure 1). Of these, 31 (12%) were recurrent cases, reported in those with a previous invasive MRSA infection. Since surveillance began in 2004, when 405 cases were reported (26.6/100,000), the incidence of invasive MRSA disease has decreased 38 percent. The mean and median ages of cases reported in 2008 were 59 and 60 years, respectively (range: 0-96 years). Fifty-five percent of all reported cases were male; of the 46 percent of cases for which race was reported, 86 percent were white, 9 percent were black, and 5 percent were of another race. The highest incidence of invasive MRSA disease occurred among residents of Multnomah county (22.3/100,000); followed by residents in Clackamas (16.2/100,000) and Washington (8.8/100,000) counties. Forty-one cases were fatal, for mortality and case fatality rates of 2.5/100,000 and 15 percent, respectively. The case fatality rate has not changed since 2004. The mean and median ages of death due to invasive MRSA infection were equivalent at 70 years, with a range of 23 to 95 years. Risk of death was associated with increasing age (p=0.0003). Among those who died, 68 percent were 65 and older, and 90 percent were 50 and older; one death (2%) occurred among those younger than 35 years of age.

Figure 1: Incidence of Invasive MRSA Cases, by Infection Type, 2004-2008.



Of the 267 total cases reported, 36 (13%) were HO (2.2/100,000); 175 (66%) were HACO (10.8/100,000); and 56 (21%) were CA (3.5/100,000). Since 2004, the incidence of HO has decreased 66 percent, that of HACO has decreased 28 percent and that of CA has decreased 31 percent (Figure 1). HO cases have comprised a *decreasing* proportion of all MRSA cases, from 25 percent in 2004 to 13 percent in 2008 (test for trend, p=0.0001), while HACO cases have comprised an *increasing* proportion of all MRSA cases, from 57 percent in 2004 to 66 percent in 2008 (p=0.0298). The proportion of CA cases did not change significantly over time.

Figure 2: Incidence of Invasive MRSA, by Infection Type and Age, 2008.



Epidemiologic classification of cases as HO, CA, or HACO-MRSA was associated with age (Figure 2). The mean and median ages for CA (48 and 49, respectively) were significantly lower than those seen for HACO (63 for each) (p<0.0001), but not for HO (56 and 60, respectively). Classification was not associated with sex or race. Mortality was highest among HACO cases (1.5/100,000), followed by HO (0.7/100,000) and CA (0.3/100,000); case fatality was highest among HO (33%), followed by HACO (14%) and CA (9% each). However, after adjusting for age, the

odds of death were 1.6 times *lower* (Odds Ratio [OR] 1.6; 95% Confidence Interval [CI] 1.0, 2.5]) for HACO cases than CA cases, and almost two times *higher* (OR 1.8; 95% CI [1.2, 2.9]) for HO cases than CA cases.

Clinical Manifestations

The most common clinical manifestations of invasive MRSA infections reported in 2008 are displayed in Table 1. The profiles for these syndromes are not significantly different from those reported during 2004-2007 with the exception of arthritis and endocarditis ($p<0.0001$ for both syndromes). Cases with healthcare-associated risk factors (including HO and HACO) were more likely to manifest as bacteremia (OR 2.2; CI 1.0, 4.5) than CA cases, while CA cases were more likely to manifest as an abscess from a normally sterile site (OR 2.2; CI 1.1, 4.8) and cellulitis (OR 2.4; CI 1.1, 4.9) than HO and HACO cases. Other syndromes were reported similarly across infection types. Compared with other clinical manifestations, a fatal outcome was almost three times more likely with pneumonia (CI 1.2, 5.7). This effect was independent of age and infection type.

Table 1: Common Clinical Manifestations of Invasive MRSA Cases, by Infection Type, 2008.†

	HO N (%)	HACO N (%)	CA N (%)	Total N (%)
Bacteremia	31 (86)	154 (88)	43 (77)	228 (85)
Pneumonia*	11 (31)	26 (15)	10 (18)	47(18)
Cellulitis	3 (8)	23 (13)	14 (25)	40 (15)
Abscess	2 (6)	23 (13)	13 (23)	38 (14)
Osteomyelitis	3 (8)	18 (10)	5 (9)	26 (10)
Urinary Tract Infection	0 (0)	13 (7)	3 (5)	16 (6)
Bursitis	0 (0)	7 (4)	4 (7)	11 (4)
Arthritis	3 (8)	4 (2)	3 (5)	10 (4)
Empyema	1 (3)	2 (1)	6 (11)	9 (3)
Endocarditis	0 (0)	4 (2)	2 (4)	6 (2)
Peritonitis	2 (6)	2 (1)	1 (2)	5 (2)
Meningitis	0 (0)	2 (1)	1 (2)	3 (1)
None	4 (11)	5 (3)	6 (11)	15 (6)

† Some cases report more than 1 syndrome.

* Only those cases of pneumonia with a sterile site isolate are included. Sputum or endotracheal aspirates are not considered sterile sites.

Underlying Conditions

Almost all (94%) invasive MRSA cases were in individuals reporting one or more underlying diseases or conditions (Table 2). Cases with healthcare-associated risk factors (including HO and HACO) were more likely to report diabetes (OR 2.8; CI 1.4, 5.7), renal failure (OR 5.4; CI 1.9, 15.6), cardiovascular disease or congestive heart failure (CVD/CHF) (OR 5.7; CI 2.2, 15.0), COPD (OR 4.1; CI 1.4, 12.0), solid organ malignancy (OR 8.8; CI 1.2, 65.8), and stroke (OR 9.1; CI 1.2, 68.4) than CA cases.

Table 2: Common Underlying Conditions Reported Among Invasive MRSA Cases, by Infection Type, 2008.†

	HO N (%)	HACO N (%)	CA N (%)	Total N (%)
Diabetes	9 (25)	83 (47)	12 (21)	104 (39)
CVD/CHF	10 (28)	66 (38)	5 (9)	81 (30)
Renal Failure	4 (11)	58 (33)	4 (7)	66 (25)
COPD	9 (25)	42 (24)	4 (7)	55 (21)
Smoking	5 (14)	34 (19)	16 (29)	55 (21)
Immunosuppressive Therapy	8 (22)	35 (20)	5 (9)	48 (18)
Obesity	5 (14)	30 (17)	8 (14)	43 (16)
Stroke	4 (11)	26 (15)	1 (2)	31 (12)
Solid Organ Malignancy	3 (8)	26 (15)	1 (2)	30 (11)
Asthma	4 (11)	17 (10)	5 (9)	26 (10)
Alcohol Abuse	5 (14)	12 (7)	6 (11)	23 (9)
IVDU	0 (0)	9 (5)	8 (14)	17 (6)
None	4 (11)	5 (3)	6 (11)	15 (6)

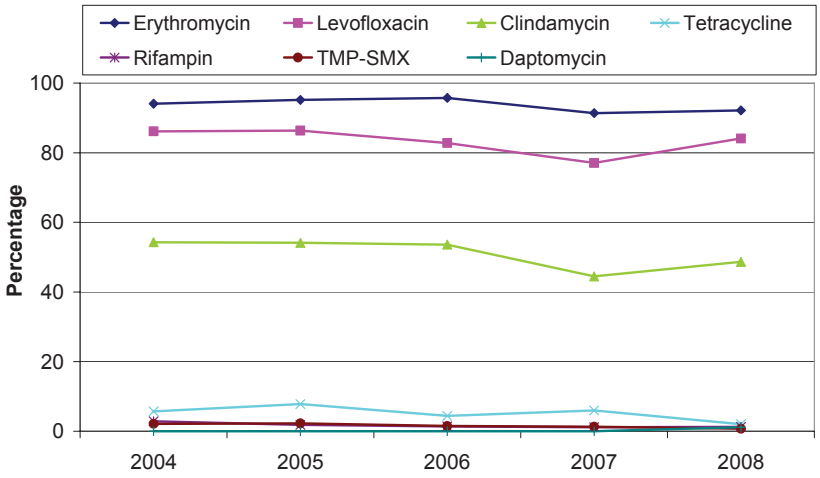
† Some cases report more than 1 condition. Not all conditions shown.

After controlling for age and infection type, only cardiovascular disease (or congestive heart failure) and immunosuppressive therapy were significantly associated with a fatal outcome ([adjusted OR 2.4; CI 1.1, 5.2] and [adjusted OR 2.5; CI 1.1, 5.8], respectively).

Antibiotic Susceptibilities

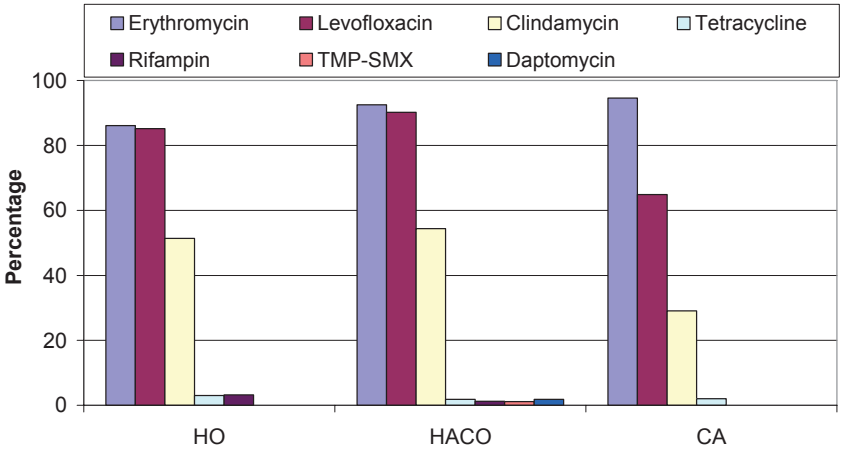
By definition, all MRSA isolates are resistant to β-lactam antibiotics, including penicillin and methicillin. Additionally, among isolates tested, a proportion displayed decreased susceptibility (intermediate or full resistance) to several commonly assayed antibiotics in 2008, including: erythromycin (92%, n=267), levofloxacin (84%, n=176), clindamycin (49%, n=261), tetracycline (2%, n=245), rifampin (1%, n=238), daptomycin (1%, n=171) and trimethoprim-sulfa (1%, n=266). Since 2004, the percentages of invasive MRSA isolates with decreased susceptibility to these select antibiotics have remained relatively stable (Figure 3). No isolates during this time period have displayed decreased susceptibility to linezolid or vancomycin. Resistance to antibiotics was not associated with a fatal disease outcome.

Figure 3: Percentage of Invasive MRSA Isolates with Decreased Susceptibility (Intermediate or Full Resistance) to Select Antibiotics, 2004-2008.



In 2008, HO and HACO cases, combined, were three times more likely to display decreased susceptibility (intermediate or full resistance) to clindamycin (95% CI 1.5, 5.4) and four times more likely to display decreased susceptibility to levofloxacin (95% CI 1.9, 10.6) than community-associated cases (Figure 4). Other differences were not statistically significant or were unable to be tested due to insufficient sample size.

Figure 4: Percentage of Invasive MRSA Isolates with Decreased Susceptibility (Intermediate or Full Resistance) to Select Antibiotics, by Infection Type, 2008.

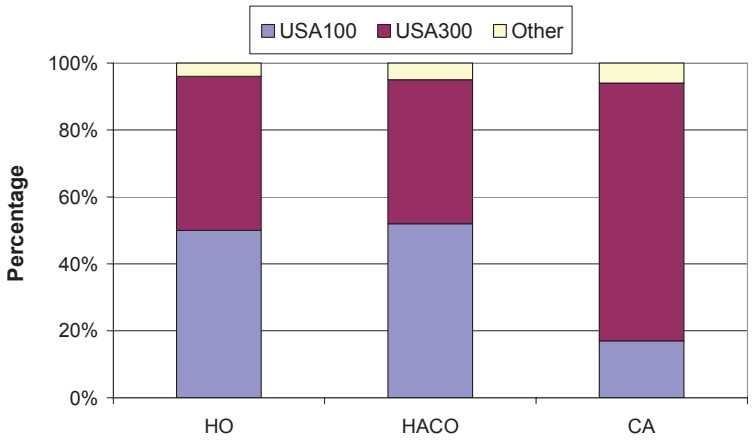


Strain Typing

Strain typing, by pulsed-field gel electrophoresis (PFGE), was completed for a subset of invasive MRSA cases (184/267 (69%)). PFGE results were available for over 90 percent of these available isolates (169/184). Of the 169 isolates, 75 (44%) were USA100, 86 (51%) were USA300, and eight (5%) were other types (i.e. USA200, 500, 800, 900, 1000).

Figure 5 displays the percentage of cases of isolates determined to be USA100, USA300, other strain type, by epidemiologically classified infection type.

Figure 5: Percentage of Isolates Typed as USA100, USA300, and Other, by Infection Type, 2008.



Among cases for which PFGE results were available, bacteremia was by far the most common clinical manifestation among those with USA100 and USA300 (93% and 97%, respectively). All other clinical syndromes were present in fewer than 25 percent of these cases. Among cases with USA100, diabetes (50%), cardiovascular disease (51%), and renal failure (37%) were the most common underlying conditions. Among those with USA300 type, diabetes (34%),smoking (26%), and cardiovascular disease (24%) were the most common underlying conditions.

Expanded HACO Analysis

The distribution of healthcare risk factors among HACO cases is shown in Table 3. Since 2004, the proportion of cases having been hospitalized or having surgery during the year prior to the date of MRSA culture significantly increased, while the proportion of cases having a central venous catheter in place at the time of culture or a previously documented MRSA infection significantly decreased ($p<0.01$ for each). Among HACO cases in 2008, 38 (22%) had one healthcare risk factor; 58 (33%) had two; 52 (30%) had three; 18 (10%) had four; 9 (5%) had five; and none had all six risk factors. The proportion of cases with multiple reported risk factors has remained stable since 2004.

Table 3: Distribution of Healthcare Risk Factors among HACO Cases, 2004-2008.

Risk Factor	Overall N (%)
Dialysis[1]	213 (21)
Central Venous Catheter[2]	222 (22)
LTCF Residence[1]	385 (37)
Prior Surgery[1]	634 (62)
Hospitalization[1]	837 (81)
Previous MRSA[3]	357 (35)

[1] Within year before date of culture
[2] In place at time of culture
[3] Ever documented infection or colonization

Dialysis, a central venous catheter (CVC) in place at the time of culture, and residence in a long-term care facility (LTCF) within the year before the date of culture, were associated with bacteremia independent of age (Table 4). Surgery was associated with abscesses from a normally sterile site and osteomyelitis. Also, the presence of multiple risk factors was significantly associated with bacteremia (OR 1.4; CI 1.2, 1.7).

Table 4: Adjusted Odds Ratios of Positive and Significant Associations between Healthcare Risk Factors and Clinical Manifestations of HACO Disease, 2004-2008.[1]

	Dialysis	CVC	LTCF	Surgery
Bacteremia	5.2 (1.8, 14.8)	6.8 (2.4, 19.6)	2.5 (1.5, 4.1)	
Abscess				2.6 (1.5, 4.5)
Osteomyelitis				1.8 (1.1, 3.0)

[1]Adjusted for age, with hospitalization within year prior to culture date as the referent group; those with previous documented MRSA colonization or infection only were excluded.

Discussion

Five full years of surveillance have allowed for a better characterization of the epidemiology of invasive MRSA disease in the Portland tri-county metropolitan area. Over this time, the incidence of invasive MRSA disease has decreased substantially, with the greatest decrease seen among HO cases. With the exception of invasive disease due to *N. meningitidis*, which has been decreasing nationally over the past several years, the stable incidence rates of other pathogens under surveillance through ABCs support a true decreasing incidence of invasive MRSA disease. The reasons for this decrease are currently unknown and will be the subject of further investigation through the ABCs program.

Results from 2008 are consistent with previous years, in that invasive MRSA disease manifests largely in those with an underlying condition or behavior that is directly related to their infection. Almost all cases in those with healthcare-defining risk factors were in those with underlying chronic diseases, such as diabetes, cardiovascular disease, renal failure, etc., that require frequent encounters with the health care system and/or invasive medical procedures. That HO and HACO cases generally increase with age and occur primarily among those 65 and older reflect the increasing prevalence of these diseases among the elderly population.

Looking at disease manifestation along with underlying conditions, several patterns emerge. For example, bacteremia commonly occurs in those with systemic conditions, such as diabetes and cardiovascular disease, which involve direct introduction of the bacteria into the blood stream through medical interventions. While type of surgery is not collected on the form, it is likely that localized joint and bone infections in the area of surgery occur after orthopedic surgeries in those areas.

The more frequent susceptibility of CA-MRSA isolates to clindamycin is consistent with the fact that a greater proportion of these are USA300 PFGE type, which usually carries fewer resistance genes than healthcare associated PFGE types. Clindamycin is not generally used as primary therapy for invasive MRSA disease. Intermediate or full resistance to vancomycin has not been detected among invasive MRSA isolates in Oregon, based on accepted breakpoint minimum inhibitory concentration (MIC) values. There are numerous reports in the medical literature of possible decreasing effectiveness of vancomycin due to small but significant

increases in resistance of MRSA to this drug, reflected in slowly rising MIC values. However, since methods for determining MICs may vary between laboratories, and isolates are generally reported as either “susceptible” or not, the extent vancomycin MICs have been increasing over time among MRSA isolates in Oregon is unclear. Additional characterization of the MRSA isolates is required to answer this question.

The use of molecular strain type information has demonstrated an increase in the traditional ‘community-associated’ USA300 strain among cases classified epidemiologically as healthcare-associated. This finding raises two possibilities: USA300 could increasingly be transmitted within the healthcare setting – at least among those with traditional healthcare risk factors – an observation supported in recently-published literature; or cases may be misclassified as healthcare-associated, due to the presence of the established ‘risk factors’, when they were actually acquired in the community.[1,2] Although both factors likely play some role, further investigation will be needed to better understand MRSA infection and invasive disease in the healthcare and community settings.

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2. Boyce JM. Community-associated Methicillin-Resistant *Staphylococcus aureus* as a cause of health care-associated infection. *Clin Infect Dis*. 2008;46:795-8.