

CRE 12-291: Checklist to Prevent MRSA Surgical Site Infections

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Background / Rationale:

Methicillin-resistant *Staphylococcus aureus* (MRSA), accounts for an estimated 94,000 invasive infections and 19,000 deaths annually in the U.S. In order to prevent MRSA infections among Veterans, the VA successfully implemented the VA MRSA Prevention Initiative that has reduced patient-to-patient transmission of MRSA. However, this Initiative does not prevent most MRSA surgical site infections (SSIs) because MRSA SSIs are usually caused by MRSA transferring from a patient's nose to their own surgical incision site. Cardiac surgery and total joint arthroplasty (TJA; e.g., hip or knee surgery) are among the most common operations performed by the VA and are associated with particularly high clinical and economic impact. In order to eliminate MRSA SSIs in the VA, the study group developed a checklist based on a meta-analysis of studies that assessed methods to prevent gram-positive SSIs among TJA and cardiac surgery patients. This SSI Checklist includes preoperatively testing a surgical patient's nose for asymptomatic MRSA colonization. If the patient is MRSA colonized, s/he will be treated with prophylactic nasal mupirocin ointment, chlorhexidine gluconate baths, and antibiotic prophylaxis with both cefazolin and vancomycin. The SSI Checklist will be implemented in 11 VA Medical Centers (VAMCs). A high-quality quasi-experimental study, with a qualitative process evaluation will be performed to assess the SSI Checklist. The goals of this project are 1) to assess the effectiveness and cost-effectiveness of the checklist to prevent MRSA SSIs among veterans undergoing TJA or cardiac surgery, and 2) to assess barriers and facilitators to checklist implementation.

Objective(s):

The goals of this project are 1) to assess the effectiveness and cost-effectiveness of the checklist to prevent MRSA SSIs among Veterans undergoing TJA or cardiac surgery, and 2) to assess barriers and facilitators to checklist implementation. Along with our operational partners, the investigative team brings complementary expertise in quantitative and qualitative health services research methods, hospital epidemiology, infection control, and implementation science. The long-term goal is to develop an effective and easy-to-implement checklist, with an accompanying implementation toolkit, that can be incorporated into the current VA MRSA Prevention Initiative to prevent MRSA SSIs in the entire VHA System.

Specific Aim 1: Implement and evaluate the effectiveness and cost-effectiveness of a SSI checklist to reduce rates of MRSA SSIs among TJA patients.

Specific Aim 2: Implement and evaluate the effectiveness and cost-effectiveness of a SSI checklist to reduce rate of MRSA SSIs among patients undergoing cardiac surgery.

Specific Aim 3: Identify and compare barriers and facilitators of implementing the SSI checklist across a diverse set of hospitals.

Methods:

This study includes both quantitative and qualitative components. In the quantitative component, the SSI Checklist was implemented in 11 VAMCs and outcomes were compared between the intervention group and two control groups: 1) 5 years of historic data from the same 11 VAMCs, 2) 8 years (5 historic year and 3 intervention years) of concurrent data from other VAMCs that did not implement the SSI Checklist. Study endpoints included: 1) MRSA SSIs as defined by the CDC; 2) SSIs caused by other pathogens; 3) cost per SSI prevented, cost per life-saved, cost per MRSA SSI prevented and cost per quality-adjusted life-year (QALY) saved. VA databases

including VA National Surgical Quality Improvement Program (VASQIP), VA Decision Support System, VA Inpatient Evaluation Center (IPEC) and Veterans' Informatics & Computing Infrastructure (VINCI) will be used to collect data. Time series analysis and linear mixed effects models will be used for the statistical analysis.

In the qualitative component, a process evaluation was conducted at 6 different VAMCs, which includes collecting data before, during, and after implementation, to examine the contextual factors and stakeholder perspectives that influence adoption of the SSI Checklist. Observations and semi-structured interviews were conducted in Years 1 and 3, along with thematic content analysis, to examine facilitators and barriers to the implementation at the different study sites. The Consolidated Framework for Implementation Research will be used to guide the process evaluation and provide the foundation for a systematic evaluation of local contextual factors that influence implementation of the SSI Checklist.

The products of this study include a validated SSI Checklist, a business-case analysis, an implementation toolkit, and a team experienced in checklist implementation for prevention of infections. At the end of this study period, the study team will meet with operational partners including National Infectious Disease Program Office (NIDS) and the MRSA / Multidrug-resistant Program Office (MDRO), and the National Center for Occupational Health and Infection Control (COHIC) to discuss implementing this checklist nationwide as part of the VA MRSA Prevention Initiative. This study has high potential to significantly decrease SSI, and in turn morbidity and mortality due to SSIs, in our Nation's Veterans.

Findings / Results:

Preliminary findings:

We successfully implemented this checklist among cardiac and orthopedic surgery patients at 11 VA medical centers. We performed qualitative interviews at baseline and during intervention at 6 of those VA medical centers. Overall, we interviewed >50 people per time period including surgeons, pre-operative nurses, laboratory personnel and hospital epidemiologists.

We identified facilitators and barriers to implementation of the checklist at VA sites. Barriers included: concern about using non-nasal formula for nasal application, difficulty obtaining nasal mupirocin formula, concern about staff resources needed for patient education, concerns about timing of and quality of patient education, concern about patient compliance with self-administered medication, concern about quality of patient self-application. Facilitators included strong nurse champions and good communication between laboratory and pre-operative clinic. Evidence-based SSI prevention algorithms may be difficult to implement in a culture that promotes constant vigilance and immediate response. Algorithms, which focus on proactive, long-term changes, may be viewed as counter to traditional "outbreak-response" cycles. Transitioning surgical services to a practice of evidence-based algorithms will take careful understanding of the history and context of local practice to engage surgical services and infection control teams in long-term change. Outcomes to date include decreased use of vancomycin at the South Texas Veterans Healthcare System. Prior to this project's implementation, antibiotic prophylaxis regimens were variable depending on the surgeon's preference. Implementation of the bundle regulated appropriate use of vancomycin prophylaxis. Some VA sites are starting processes to expand bundle to other surgery practices including spine, vascular, and neurosurgery. Sites have collected over 800 isolates, which will be analyzed to confirm the antibiotics in the bundle do not lead to increased resistance.

Status:

Since the initial approval period, we have completed all of the qualitative process evaluations (Aim 3). This involved traveling to six sites (Iowa City, Omaha, Minneapolis, Miami, Portland, and Baltimore) to conduct semi-structured interviews with members of the infection control team as well as with leadership and focus groups with health care workers. We are writing up the

results of those visits. Madison VA was added as a site in 2016. The SSI checklist intervention was implemented all eleven VAs and we are continuing to work with the other site to start. The intervention ended on 3/31/2018. We are now analyzing the quantitative and qualitative data.

Impact:

Aim 1 VA Benefit: TJA is the most common surgery performed in VHA. Even small reductions in the rate of TJA SSIs could greatly reduce the number of Veterans with a SSI.

Aim 2 VA Benefit: The rates of SSI after cardiac surgery are much higher than rates among other clean surgeries. In addition, mediastinitis is associated with high morbidity. A reduction in cardiac SSIs would decrease morbidity among many VA surgical patients.

Aim 3 VA Benefit: If effective, the checklist can be implemented throughout VA as part of the MRSA Prevention Initiative. We will identify facilitators and modifiable barriers to ensure smooth implementation at other VA sites.

Additional Information:

Pre-intervention and post-intervention site visits and study interviews were completed with six sites.

Journal Articles

1. Carrel M, Goto M, Schweizer ML, David MZ, Livorsi D, Perencevich EN. Diffusion of clindamycin-resistant and erythromycin-resistant methicillin-susceptible *Staphylococcus aureus* (MSSA), potential ST398, in United States Veterans Health Administration Hospitals, 2003-2014. *Antimicrobial resistance and infection control*. 2017 Jun 5; 6:55.
2. Goto M, Schweizer ML, Vaughan-Sarrazin MS, Perencevich EN, Livorsi DJ, Diekema DJ, Richardson KK, Beck BF, Alexander B, Ohl ME. Association of Evidence-Based Care Processes With Mortality in *Staphylococcus aureus* Bacteremia at Veterans Health Administration Hospitals, 2003-2014. *JAMA internal medicine*. 2017 Oct 1; 177(10):1489-1497.

Journal Other

3. Safdar N, Perencevich E. Crossing the quality chasm for *Clostridium difficile* infection prevention. [Editorial]. *BMJ quality & safety*. 2015 Jul 1; 24(7):409-11.