



Colorado Department of Public Health and Environment
Health Facility Acquired Infections Disclosure Initiative
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Surgical Site Infections Associated with Inpatient Cardiac and Orthopedic Operative
Procedures and Associated Pathogens in Colorado (2007 to 2010)

Introduction

This report was written to fulfill the requirements set forth in the Colorado Hospital-Acquired Infections Disclosure Act. The Act requires hospitals, hospital units, ambulatory surgery centers and dialysis treatment centers to report health facility acquired infections data as a condition of their state licensure. The Colorado Department of Public Health and Environment (CDPHE) is the lead state agency administering the initiative. CDPHE is required to produce semi-annual bulletins disclosing the results of these data collected.

The Colorado Hospital-Acquired Infections Disclosure Act defines specific clinical procedures for which facilities shall collect and report health facility-acquired infection data. Surveillance of surgical site infections (SSIs) associated with hip and knee replacements (both total and partial) and coronary bypass procedures in Colorado started August 2007. In October 2008, surveillance of infections associated with hernia procedures began, and most recently, surveillance began in August 2009 for SSIs associated with vaginal and abdominal hysterectomies.

This bulletin is the first semi-annual bulletin for 2011 and focuses on surgical site infections (SSIs) in Colorado Hospitals compared to the national averages, as well as the pathogens associated with SSIs in Colorado. The tables and graphs in this bulletin show the results of SSI data collected by healthcare facilities (hospitals and ambulatory surgery centers) that perform hip and knee replacement (total or partial) procedures and coronary artery bypass graft procedures. The reporting period includes surgeries performed from August 2007 through July 2010. The decision to focus on these three surgeries was based on having three complete years of data to show trends over the course of surveillance.

Surgical Site Infections

Colorado healthcare facilities report the mandated procedures using the Centers for Disease Control and Prevention's National Healthcare Safety Network (NHSN) definitions and online reporting system. A NHSN operative procedure is a procedure 1) that is performed on a patient who is an in- or an outpatient; and 2) takes place during an operation (defined as a single trip to the operating room (OR)) where a surgeon makes at least one incision through the skin or mucous membrane, including laparoscopic surgeries, and closes the incision before the patient leaves the OR.

Surgical site infections (SSIs) are infections directly related to operative procedures. Infections can occur at the site of the incision typically within the first 30 days of the procedure or within one year if an implant is left in place. Most of the procedures discussed in this bulletin involve an implant. Symptoms of an infection can include drainage from the incision, pain, tenderness, swelling or redness. It is important to note that for some implant procedures reported in this bulletin, only nine months has passed following the procedure. There is potential for additional infections to develop and those will be included in subsequent reports.

Operative Procedures in this Bulletin

Hip prosthesis is hip joint replacement surgery that replaces all or part of the hip joint with an artificial device. The procedure consists of a cup, (typically plastic, ceramic or metal) to replace the hip socket, a metal or ceramic ball that replaces the head of the thighbone, and a metal stem that attaches to the bone. Knee prosthesis is a knee joint replacement that replaces all or part of the knee joint with an artificial device. In this procedure, the patella (kneecap) is removed, the femur (thigh bone) and tibia (shin bone) are cut down, and a metal, ceramic or plastic prosthesis is put in place. A coronary artery bypass procedure bypasses blocked heart arteries by creating new passages for blood to flow to the heart muscle. Arteries or veins from other parts of the body are used as grafts to create alternative blood flow pathways.

Risk for Surgical Site Infection and Standardized Infection Ratio

Some surgical patients have a higher risk for developing SSIs due to their health at the time of surgery and specific factors surrounding the actual procedure. NHSN assigns each surgical patient a risk category based on risk factors collected by each reporting facility. These risk factors include: (1) Duration of procedure, (2) Wound class (clean, contaminated, or dirty/infected), and (3) the American Society of Anesthesiologists (ASA) score. The ASA score, a pre-operative rating assigned to each patient is a measure of the patient's general health status and co-existing conditions assigned by the anesthesiologist. Currently, the ASA score is the only indicator in the NHSN system of pre-existing conditions. The patient's risk category is assigned by NHSN based on the number of risk factors at the time of surgery. Patients with no risk factors are considered low risk; patients with one risk factor are considered moderate risk; and patients with two or three risk factors are considered high risk.

NHSN uses data collected from healthcare facilities nationally to estimate the number of predicted SSIs for Colorado's procedures taking into consideration the health of each patient at the time of surgery. This prediction is based on the type of procedure and the risk category described above. The predicted number of infections is used to compare facilities to the nation. To describe how Colorado facilities are compared to national facilities, NHSN uses the Standardized Infection Ratio (SIR). The SIR is a simple statistic calculated by dividing the number of SSIs observed in Colorado by the predicted number of SSIs for Colorado. If these numbers are the same, the result is one, which means Colorado matches the national infection rate of SSIs. If the SIR is less than one, Colorado has fewer infections than predicted from the national rate, and if the SIR is greater than one, Colorado has more infections than predicted from the national rate. The greater the difference the SIR is from one is the magnitude of difference between Colorado and the nation, better or worse. The figures in this bulletin show the observed number of infections in Colorado, the number predicted based on the patients' population undergoing procedures, and the SIR. A statistical test (Poisson test) is used to determine if the difference is statistically significant. It is important to note that it is possible for the SIR to be higher or lower than 1.0, but, due to statistical comparison and the total number of procedures and infections, not be significantly better or worse than the national rate.

Results

The table and graphs below present data from surgeries performed from August 1, 2007 – July 31, 2010.

Table 1 shows procedure data submitted by all reporting facilities in Colorado. It contains a summary of the number of procedures performed, the number of SSIs observed, the number of SSIs predicted, the SIR comparing SSIs observed in Colorado compared to the predicted number, and whether the SIR is statistically different (not due to random chance alone) when compared to the national rate.

There are three categories summarizing how Colorado compares to the other hospitals in the nation for each specific procedure.

1. Colorado has a statistically lower (better) infection rate than the national rate;
2. Colorado has an infection rate that is statistically the same as the national rate; or
3. Colorado has a statistically higher (worse) infection rate than the national rate.

Table 1. Summary of Colorado Procedures and Surgical Site Infections with Comparison to National Rates: August 2007 – July 2010

Procedure	Time frame	Number of facilities reporting	Number of procedures	Number of SSIs	Predicted SSIs	Standardized Infection Ratio	Comparison to national rate
Coronary artery bypass graph	Aug 2007 - Jul 2010	18	5,702	104	173	0.60	Better
Hip prosthesis	Aug 2007 - Jul 2010	59	21,468	256	262	0.98	Same
Knee prosthesis	Aug 2007 - Jul 2010	61	34,381	321	298	1.08	Same
Abdominal hysterectomy	Aug 2009 - Jul 2010	54	4,470	73	73	1.0	Same
Vaginal hysterectomy	Aug 2009 - Jul 2010	47	3,162	31	27	1.15	Same
Inpatient herniorrhaphy	Oct 2008 - Jul 2010	66	5,411	131	113	1.16	Same
Outpatient herniorrhaphy	Oct 2008 - Jul 2010	105	25,599	81	128	0.63	Better
All Colorado procedures	Aug 2007 - Jul 2010	105	100,193	997	1,074	0.93	Better

For all procedures Colorado performs the same as or better than the national rate. Colorado is statistically better than the national rate for infections associated with coronary artery bypass procedures (40% fewer than predicted), outpatient herniorrhaphy procedures (37% fewer than predicted), and all procedures combined (7% fewer than predicted). The difference seen between the Colorado and national infection rates are not due to random chance alone. Colorado's infection rate is statistically the same as the national infection rate for hip and knee replacement procedures, abdominal and vaginal hysterectomy procedures, and inpatient herniorrhaphy procedures.

Figure 1 shows the observed and predicted number of infections and SIR for knee replacement procedures for the first three years of surveillance. This graph shows that in the first year of surveillance, Colorado's infection rate was statistically worse than the national average, but has since decreased to match the predicted number of infections. The number of surgeries performed each year is listed below the date in the graph.

Figure 1. Knee Replacement (total and partial) Procedures: Observed Surgical Site Infections versus Expected Surgical Site Infections and SIR for August 2007-July 2010

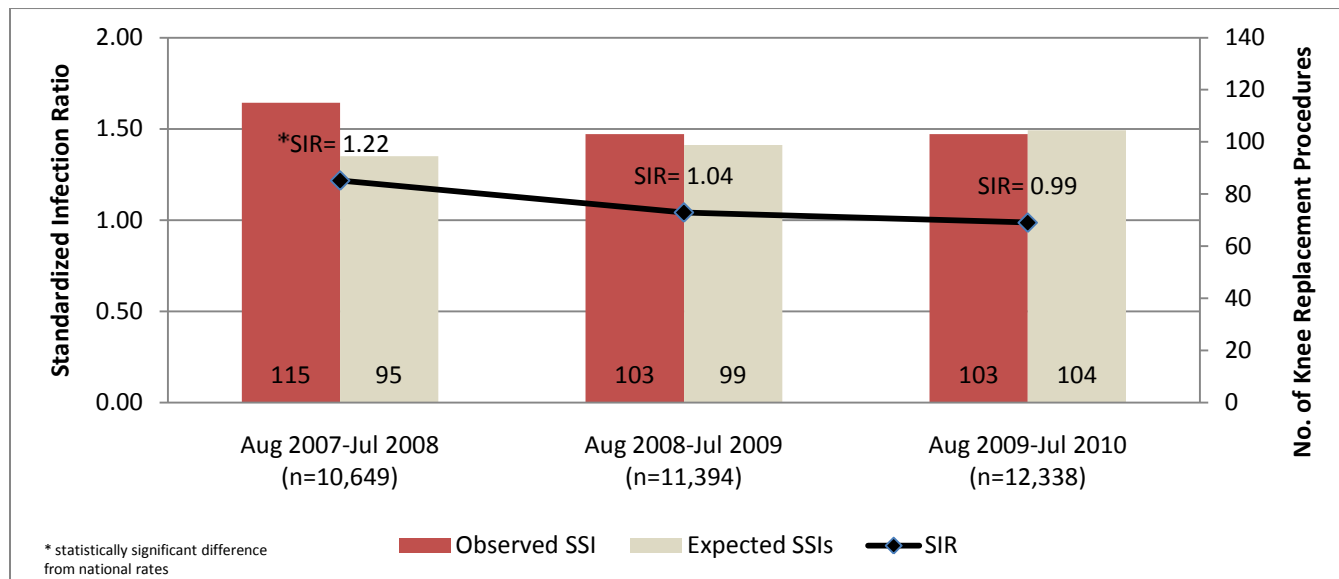


Figure 2 shows the observed and predicted number of infections and SIR for hip replacement procedures for the first three years of surveillance. At the start of surveillance, Colorado had 13% fewer infections than predicted, though this was not a statistically significant difference than the national rate. In the two subsequent years, infections in these procedures increased to match the number predicted. However, this was not statistically significant, so an increase was likely due to random chance. The number of surgeries performed each year is listed below the date in the graph.

Figure 2. Hip Replacement (total and partial) Procedures: Observed Surgical Site Infections versus Expected Surgical Site Infections and SIR for August 2007-July 2010

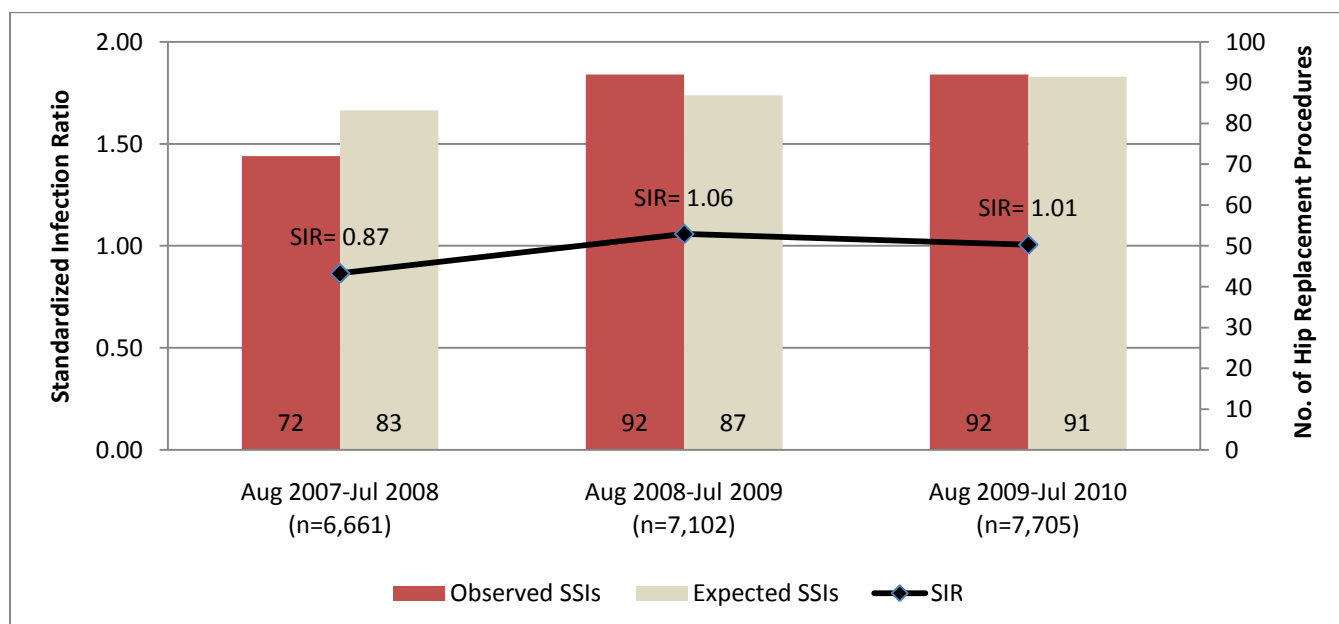


Figure 3 shows the observed and predicted number of infections and SIR for coronary artery bypass procedures for the first three years of surveillance. For this procedure, Colorado's infection rate has been lower than the national rate for all years of surveillance, and is statistically significant. The first year Colorado had 56% fewer infections than expected. The number of infections increased the next two years, as compared to the national rate, though continues to remain statistically better than the national rate. The number of surgeries performed each year is listed below the date in the graph.

Figure 3. Coronary Artery Bypass Grafts with Chest and Donor Site Procedures: Observed Surgical Site Infections versus Expected Surgical Site Infections and SIR for August 2007-July 2010

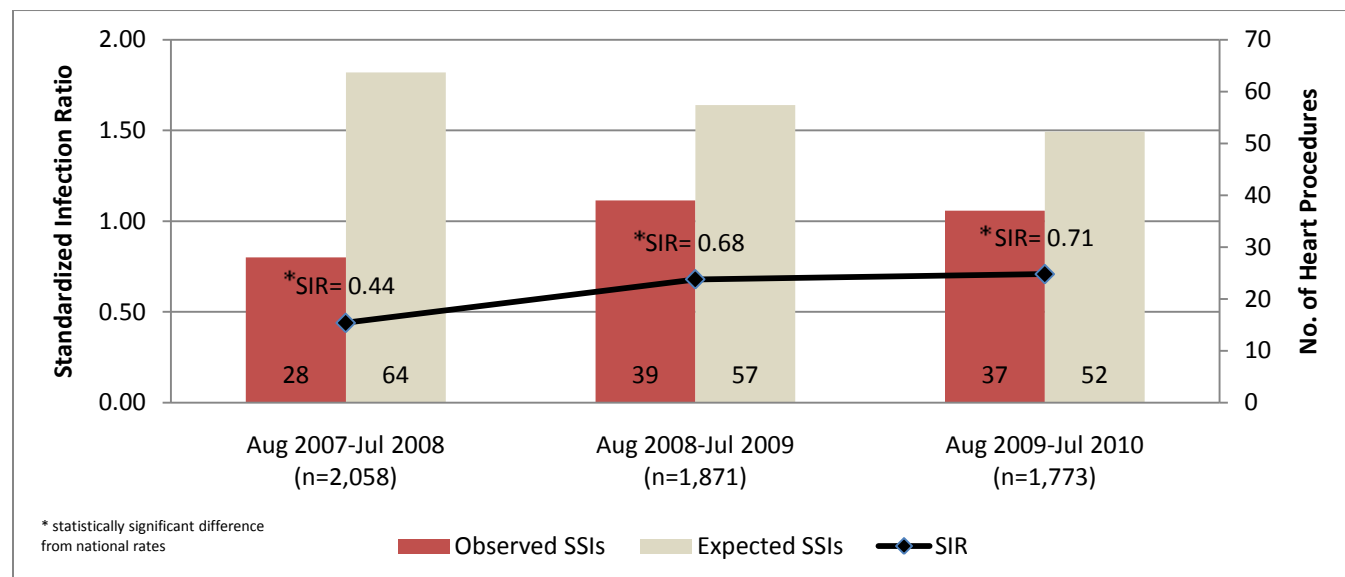


Figure 4 shows the six most frequent pathogens seen in Colorado SSIs by procedure. As expected, *Staphylococcus aureus* is the most common cause of SSI in Colorado, causing the majority of all hip and knee replacement procedures and herniorrhaphy procedures. *Staphylococcus aureus* and coagulase negative *Staphylococcus* species are common contaminants of the skin and environment. These organisms can originate from the patient's own flora or be transferred from a healthcare provider or the environment. Other common causes of SSIs in Colorado are pathogens from either the *Enterococcus* or *Eschericia* families, typically found in the gastrointestinal tract. These organisms are responsible for the majority of SSIs associated with hysterectomy procedures, especially vaginal hysterectomies. This is due to the proximity of these procedures to where the organisms originate.

Figure 4. Colorado Surgical Site Infection Pathogens by Procedure type: August 2007-July 2010

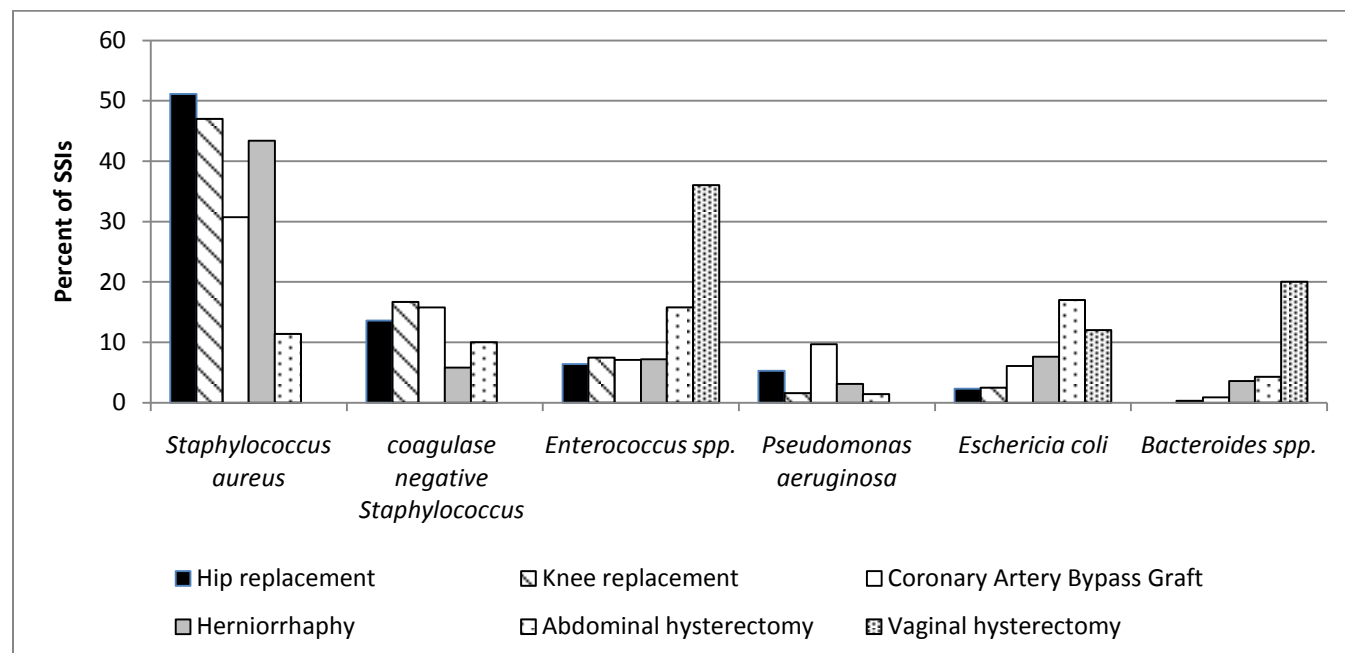
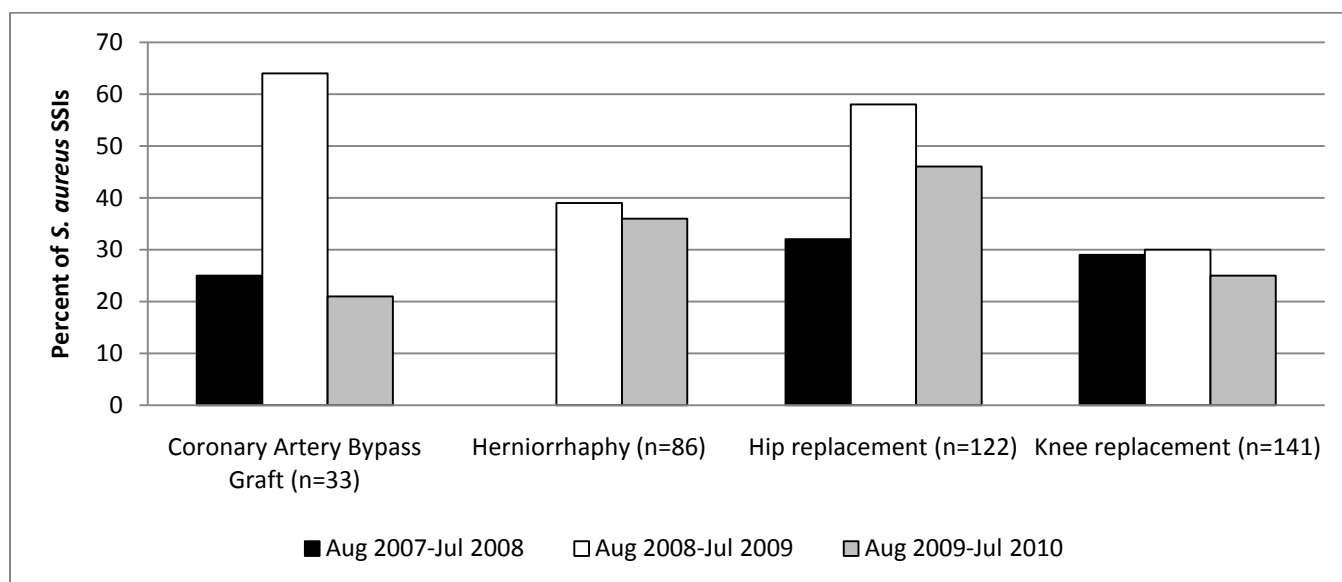


Figure 5 shows the percentage *Staphylococcus aureus* SSIs that are methicillin-resistant (MRSA) versus methicillin-sensitive (MSSA). MRSA is a bacterium that has developed resistance to beta-lactam antibiotics; antibiotics commonly used to treat *S. aureus* infections. MSSA is a bacterium that can be easily treated with commonly used beta-lactam antibiotics. Though efforts are taken to avoid all SSIs, and many are devastating regardless of the organism, this organism can be particularly difficult to treat and may reoccur in the same patient due to colonization. Colonization is the presence of MRSA on tissue without the presence of symptoms. Colorado does not appear to have any consistent trends in the percentage of SSIs caused by MRSA by year. Between August 2007 and July 2008 a spike is seen with coronary artery bypass procedures. This may appear more dramatic due to the small number of associated SSIs for that time period. In general, hip replacement procedures have the highest percentage of MRSA infection of all procedure types.

Figure 5. Percent of *S. aureus* infections that are caused by methicillin-resistant bacteria by Procedure and Year: August 2007 – July 2010



Causes of surgical site infection

There are many strategies physicians and patients can use to prevent surgical site infections. It is not one person's responsibility to prevent SSIs. All healthcare providers need to practice diligent hand hygiene and use proper pre-surgical preparation of the patient, including skin cleaning, hair removal and prophylactic antibiotics.

Every day patients receiving medical treatment acquire infections in healthcare facilities. Spending time in a hospital or getting surgery puts patients at risk for healthcare-associated infections (HAI), such as blood, surgical site, or urinary tract infections. These infections can have devastating physical, emotional and financial results. However, there are actions that healthcare consumers and providers can take to reduce HAI. The following ten steps, published by the Centers for Disease Control and Prevention, are simple activities that patients and their healthcare providers can follow to reduce the likelihood of acquiring HAIs and improve healthcare safety in general:

1. Speak up: Tell your doctor about any worries you have about your safety and ask them what they are doing to protect you.
2. Keep hands clean: If you do not see your providers clean their hands, ask them to do so. Also, remind your loved ones and visitors. Washing hands can prevent the spread of germs.
3. Ask your healthcare provider: "will there be a new needle, new syringe, and a new vial for this procedure or injection?" Healthcare providers should never reuse needles or syringes on more than one patient.
4. Get smart about antibiotics: Help prevent antibiotic resistance by taking all your antibiotics as prescribed, and not sharing your antibiotics with other people. Remember that antibiotics don't work against viruses like the ones that cause the common cold.
5. Know the signs and symptoms of infection: Some skin infections, like Methicillin-resistant *Staphylococcus aureus* (MRSA), appear as redness, pain, or drainage at an intravenous catheter site or surgical incision site. A fever may or may not be present. Tell your doctor if you have these symptoms.
6. Prepare for surgery: Ask your doctor what you should do to prepare for surgery and tell him/her about any medical conditions you have. The following list, published by the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, includes suggested questions to ask your surgeon and other members of your surgical team to help you prepare for surgery.

7. Ask the following questions to your healthcare provider:
- ✓ Why do I need surgery?
 - ✓ What kind of surgery do I need?
 - ✓ What will you be doing?
 - ✓ Have you done this surgery before? How many times?
 - ✓ How successful is this surgery?
 - ✓ Will I need anesthesia?
 - ✓ How long will the surgery take?
 - ✓ What will happen after the surgery?
 - ✓ What kind of pain can I expect?
 - ✓ How long will I be in the hospital?
 - ✓ How long will it take me to recover?
 - ✓ What are the benefits and risks of having this surgery?
 - ✓ What are the possible complications?
 - ✓ What are the alternatives to surgery?
 - ✓ How much will the surgery cost?
 - ✓ Will my insurance cover the surgery?
 - ✓ Why is your hospital best for this surgery?

Providers should educate their patients how to care for themselves to prevent infections. For more information about preventing surgical site infections please access: http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/SSI_tagged.pdf.

Organisms that cause SSIs often depend on the type of surgery and location on the body it involves. Procedures not involving the respiratory tract, intestinal tract, or gynecological tract often have infections caused by *S. aureus*. The origin of this organism is the patient's own normal flora or from the environment. SSIs from these other body locations are caused by organisms more common to that area. (<http://www.cdc.gov/ncidod/eid/vol7no2/nichols.htm>)

Resources for consumers

Healthcare quality means that patients get the right medicine, treatments, and medical tests at the right times for their condition. There are many resources available to inform decisions about quality care, infection data and rates, questions to ask your doctor, and where to receive healthcare. Some examples are listed here:

Centers for Disease Control and Prevention	www.cdc.gov
Colorado Hospital Association	www.cha.com
Institute for Healthcare Improvement	www.ihl.org
Colorado Consumer Health Initiative	www.cohealthinitiative.org
Colorado Department of Public Health and Environment Patient Safety Program	www.cdphe.state.co.us/hf/patientsafety/index.html

Cautions

There are some cautions to consider when interpreting these data in this report. Infections are not the only adverse event that may occur in healthcare. It is important to weigh other factors in judging the quality of healthcare. Consumers should always consult with their doctor, healthcare facility, health insurance carrier, family and friends before deciding where to receive care. Consumers should consider the experience of the facility, staff and other quality of care indicators in addition to the SSI data below.

It is important to note, initiatives involving electronic reporting systems require time to allow facilities to become familiar with the requirements and ensure the system is used correctly. Acute care hospitals have been reporting to the NHSN since 2007. However, NHSN definitions are complex and can be interpreted differently. CDPHE will not know how facilities are interpreting and applying the definitions until data validation studies are conducted. Validation of the surgical procedure data is planned for summer of 2011.