Surgical Site Infection
NICE Quality Standards

Pauline Harrington
Surveillance Manager

Dept. Healthcare-Associated Infection & Antimicrobial Resistance
Public Health England
Overview

- Background on Surgical Site Infection
- Risk Factors
  - Evidence based guidance - what works
  - Presenting the 7 NICE quality statements and How to deliver them
  - How to implement statement 7 effectively - SSI surveillance (including post-discharge infections) and feedback of results to influence clinical practice
  - Update on Public Health England Surgical Site Infection Surveillance Service
Background

- SSI accounts for 16% of HCAIs (HPA prevalence survey)*

- It can cause patients extreme pain and discomfort (Plowman et al 2001, Coello et al 2005). It can lead to extended hospital stay and cost to the NHS approximately 700 million pounds for acute care (Under the knife)

- SSI rate varies between hospitals and between categories

- Risk varies depending on the degree of wound contamination
  e.g. colorectal surgery carries a higher risk than orthopaedic surgery

Risk Factor

Endogenous (patient related)
- Age, patient flora, operation duration
- Diabetes, immune status
- Obesity, hypothermia, poor nutrition

Exogenous (environmental)
- Surgical personnel, breaks in aseptic technique
- Inadequate hand hygiene, surgical technique
- Physical environment and ventilation
- Tools, equipment, materials brought to the operative field
Evidence based guidance

Implementation of guidance to reduce the risk of SSI and promote patient safety

- EPIC guidelines 1, 2 & 3
- WHO Surgical Safety Checklist – could save half a million lives a year worldwide if implemented
- High Impact Intervention (care bundles)
- Aseptic Non-Touch Technique (ANTT) Competencies

- NICE SSI Quality Standards
# Systematic review of evidence base

<table>
<thead>
<tr>
<th>Period</th>
<th>Action</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-operative</strong></td>
<td>Showering</td>
<td>+/-</td>
</tr>
<tr>
<td></td>
<td><em>S. aureus</em> decolonisation</td>
<td>+/-</td>
</tr>
<tr>
<td><strong>Peri-operative</strong></td>
<td>Antibiotic prophylaxis</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Skin preparation</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>No shaving with razors</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Theatre environment/procedures</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Surgical technique</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Normothermia</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Glucose control</td>
<td>+</td>
</tr>
<tr>
<td><strong>Post-operative</strong></td>
<td>Wound management</td>
<td>+/-</td>
</tr>
<tr>
<td></td>
<td><em>Surveillance &amp; feedback of rates</em></td>
<td>+</td>
</tr>
</tbody>
</table>

Preoperative actions

MRSA screening
- All patients undergoing implant, cardiothoracic, orthopaedic and neurosurgical procedures
- Other patients according to local Trust policy, eg vascular procedures.

MRSA decontamination
- A recommended technique for MRSA decolonisation is available from the Hospital Infection Society website. ⁵

Perioperative actions

Hair removal
- Use a clipper with a disposable head.
- Shaving with a razor is not recommended. ⁵

Prophylactic antimicrobial
- Appropriate antimicrobial administered within 60 minutes prior to incision. ¹³,¹⁴

Normothermia
- Maintaining a body temperature above 36°C in the perioperative period has been shown to reduce infection rates. ¹⁶,¹⁷

Glucose control
- Maintaining a glucose level < 11 mmol/l has been shown to reduce wound infection in diabetic patients. ¹⁵
SSI Quality Standards

Statement 1. People having surgery are advised not to remove hair from the surgical site and are advised to have (or are helped to have) a shower, bath or bed bath the day before or on the day of surgery (Webster 2007).

Statement 2. People having surgery for which antibiotic prophylaxis is indicated receive this in accordance with the local antibiotic formulary (Andersen 2005).

Statement 3. Adults having surgery under general or regional anaesthesia have normothermia maintained before, during (unless active cooling is part of the procedure) and after surgery (Kurz et al 1996).
Statement 4. People having surgery are cared for by an operating team that minimises the transfer of microorganisms during the procedure by following best practice in hand hygiene and theatre wear, and by not moving in and out of the operating area unnecessarily. (Lipp 2002),

Statement 5. People having surgery and their carers receive information and advice on wound and dressing care, including how to recognise problems with the wound and who to contact if they are concerned (Whitby 2007).

Statement 6. People with a surgical site infection are offered treatment with an antibiotic that covers the likely causative organisms and is selected based on local resistance patterns and the results of microbiological tests.
NICE Quality Standards

**Statement 7.** People having surgery are cared for by healthcare providers that monitor surgical site infection rates (including post-discharge infections) and provide feedback to relevant staff and stakeholders for continuous improvement through adjustment of clinical practice.
Why implement the standards?

- Evidence based
- Ensure patients receive the best and most appropriate treatment / care
- Care Quality Commission – essential standards of quality and safety (subject to scrutiny by CQC)
- NHS Litigation Authority (NHSLA)
- Risk Management Standards
- Assurance of Compliance required- NHS Standard Contract
Priority Areas and Challenges

Priority:
The 7 statements are key priorities as there is sufficient evidence to demonstrate that by implementing these statements can lead to the reduction of the incidence of SSIs.

Challenges:
Leadership and ownership
Resources
Engaging all staff
Delivering on the 7 quality Statements

• Identify a lead to coordinate implementation
• Governance Lead – perform a gap analysis and enter on Risk Register
• Create an action plan for implementation
• Clinical Audit and Assurance Manager to assist in implementing the standards
• Health care professionals are informed of the standards and process of implementation
• Audit to ensure that standards are implemented and adhered to consistently Trust wide
SSI Surveillance

**Statement 7.** People having surgery are cared for by healthcare providers that monitor surgical site infection rates (including post-discharge infections) and provide feedback to relevant staff and stakeholders for continuous improvement through adjustment of clinical practice.
What is surveillance?

“Ongoing, systematic collection, analysis, and interpretation of health data ....closely integrated with the timely dissemination to those who need to know. Application of the data to preventing and controlling disease.”

Centers for Disease Control and Prevention. Comprehensive plan for epidemiologic surveillance. 1986. Atlanta, GA: CDC
Why is surveillance important?

- Decreased infection rate
  - Improved patient experience
  - Reduced LOS
  - Reduced costs to primary and secondary care

- Mandatory (orthopaedics)

- Care Quality Commission and CNST requirement

- Patient choice (website)
3. Surgical Site Infection Surveillance

National database established by Public Health Laboratory Service in 1997 to enable comparisons within and between hospitals to facilitate improvement in quality of patient care

**Participation**

- 361 hospitals in England registered (274 NHS, 87 independent sector)
- 17 categories of surgical procedure
- Mandatory surveillance in orthopaedics from April 2004
- Approx 150 000 records submitted/year
Quarterly Participation in SSISS April 2004 - March 2012
Implementing Surveillance effectively

- **Ensure that resources are available** (Trust Board, infection, surgical audit meetings)

- **Form a committee** (Infection prevention & control specialist, Surveillance nurse, Microbiologist, Surgeons, Representative Trust board, Clinical governance/quality representative Senior nurses from theatres and surgical wards)
  - To support and direct surveillance
  - Oversee data collection and governance
  - Review reports and planning improvements in practice
Implementing Surveillance effectively

• Choose priority categories (mandatory and categories of concern) quality rather than quantity
• Choose a champion who can raise the profile of surveillance
• Multidisciplinary team work
• Training in SSI methodology by PHE
• Dissemination of data to those who need to know
• Examine and understand the data (Risk factor, benchmark, outlier status)
• Use the results to change practice if/when needed
• Publicise good results or learn from others
• Seek support from PHE
SSI surveillance service methodology

- targeted at categories of related surgical procedures
- protocol outlines standard case definition and follow-up methods
- data collection form completed for every eligible operation (denominator)
- systematic active surveillance after each operation to detect all infections (numerator)
- data scrutinised centrally to ensure high quality maintained
- standardised methods provide comparable data between hospitals

\[
\frac{\text{no. infections}}{\text{no. patients undergoing surgery}} \times 100 = \% \text{ infected}
\]
Methods of identifying patients with hospital-acquired infection

**Active**

Designated, trained personnel, use a variety of data sources to determine whether an HAI has occurred

Sensitivity = 85-100%

**Passive**

HAI identified and reported by people other than designated, trained personnel. *Requires fewer people but may be unreliable/ definitions may not be applied consistently*

Sensitivity = 14-34%

Sensitivity of case finding

- **Lab-based phone**
  Sensitivity 36%
  1.2hrs / 100 beds / week

- **Temperature / treatment chart**
  Sensitivity 65%
  6.5 hours / 100 beds / week

- **Lab-based, ward liaison**
  Sensitivity 76%
  6.4 hours / 100 beds / week

### Adverse impact of SSI on length of stay (LOS)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Median LOS (no SSI)</th>
<th>Extra LOS* (with SSI)</th>
<th>Extra costs* due to SSI (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limb amputation</td>
<td>13.2</td>
<td>21.0</td>
<td>6103</td>
</tr>
<tr>
<td>Vascular</td>
<td>7.9</td>
<td>12.2</td>
<td>3545</td>
</tr>
<tr>
<td>Large bowel</td>
<td>11.3</td>
<td>9.4</td>
<td>2732</td>
</tr>
<tr>
<td>CABG</td>
<td>7.4</td>
<td>13.4</td>
<td>3894</td>
</tr>
<tr>
<td>ORLB fracture</td>
<td>9.6</td>
<td>9.9</td>
<td>2877</td>
</tr>
<tr>
<td>Hip prosthesis</td>
<td>11.1</td>
<td>11.5</td>
<td>3342</td>
</tr>
<tr>
<td>Knee prosthesis</td>
<td>10.3</td>
<td>10.9</td>
<td>3168</td>
</tr>
</tbody>
</table>

*adjusted by age, sex, pre-op stay, ASA score, wound class, duration of operation, multiple procedures, emergency, trauma

Excess mortality according to SSI type

77% of deaths in patients with SSI estimated to be directly attributable to infection

## Excess mortality patients with deep and organ/space SSI

<table>
<thead>
<tr>
<th></th>
<th>SSI vs. no SSI</th>
<th></th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular surgery</td>
<td>6.8 (3.0 – 15.4)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Large bowel</td>
<td>1.8 (1.1 – 3.2)</td>
<td></td>
<td>&lt;0.04</td>
</tr>
<tr>
<td>Hip prosthesis</td>
<td>2.5 (1.3 – 4.6)</td>
<td></td>
<td>0.005</td>
</tr>
</tbody>
</table>

*adjusted by age, sex, pre-op stay, ASA score, wound class, duration of operation, multiple procedures, emergency, trauma

77% of deaths in patients with SSI estimated to be directly attributable to the infection

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Report section on SSI web application

Infection Rate reports:
- Hospital & benchmark
- Risk index (composite of 3 factors)
- Other Risk factors
- Type SSI
- Micro-organisms
Summary report – crude incidence

Hip replacement

April - June 2010

Table 1: No of operations and completed post-discharge questionnaires with rates of SSI by current and last 4 periods at your hospital.

<table>
<thead>
<tr>
<th>Operations &amp; surgical site infections</th>
<th>Your hospital</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current period</td>
<td>Last 4 periods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total no.</td>
<td>78</td>
<td>329</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. with PQ given</td>
<td>71</td>
<td>292</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% PO completed</td>
<td>87.3%</td>
<td>88.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical Site Infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. inpatient/readmission</td>
<td>2</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>2.6%</td>
<td>4.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. post-discharge confirmed</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>0.0%</td>
<td>0.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. patient reported</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>0.0%</td>
<td>0.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All SSI</td>
<td>2</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>2.6%</td>
<td>5.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Results from all hospitals in this surgical category (last 5 years)

<table>
<thead>
<tr>
<th>Operations &amp; surgical site infections</th>
<th>All hospitals</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without PQ</td>
<td>With PQ</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td>157164</td>
<td></td>
</tr>
<tr>
<td>Total no.</td>
<td>136329</td>
<td>20835</td>
<td>157164</td>
<td></td>
</tr>
<tr>
<td>% PO completed</td>
<td>-</td>
<td>59.5%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Surgical Site Infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. inpatient/readmission</td>
<td>1164</td>
<td>101</td>
<td>1265</td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>0.8%</td>
<td>0.5%</td>
<td>0.8%</td>
<td></td>
</tr>
<tr>
<td>No. post-discharge confirmed</td>
<td>231</td>
<td>76</td>
<td>307</td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>0.2%</td>
<td>0.4%</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>No. patient reported</td>
<td>No data</td>
<td>163</td>
<td>184</td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>No data</td>
<td>0.8%</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>All SSI</td>
<td>1595</td>
<td>340</td>
<td>1750</td>
<td></td>
</tr>
<tr>
<td>% infected</td>
<td>1.6%</td>
<td>1.6%</td>
<td>1.1%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Rates of SSI by inpatient/readmission, post-discharge confirmed and patient reported SSIIs for the current and last 4 periods compared to data from all hospitals.

Note: a more precise estimate of the incidence of SSI can be made by cumulating data over several surveillance periods.
### SSI risk stratification in large bowel surgery

#### Rate of SSI by Surgery Type

**Category**: Large bowel surgery  
**Data between**: Jul-2008 and Jun-2010  
**Hospital**: Hospital [x]

<table>
<thead>
<tr>
<th>Surgery Type</th>
<th>Operations</th>
<th>No. SSI</th>
<th>% infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Inpatient &amp; readmissions</td>
<td>All*</td>
</tr>
<tr>
<td>Elective</td>
<td>164</td>
<td>34</td>
<td>9.3%</td>
</tr>
<tr>
<td>Emergency</td>
<td>33</td>
<td>8</td>
<td>8.0%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total</td>
<td>197</td>
<td>42</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

#### All hospitals

<table>
<thead>
<tr>
<th>Surgery Type</th>
<th>Operations</th>
<th>No. SSI</th>
<th>% infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Inpatient &amp; readmissions</td>
<td>All*</td>
</tr>
<tr>
<td>Elective</td>
<td>9030</td>
<td>809</td>
<td>91.1%</td>
</tr>
<tr>
<td>Emergency</td>
<td>810</td>
<td>140</td>
<td>8.2%</td>
</tr>
<tr>
<td>Unknown</td>
<td>70</td>
<td>10</td>
<td>0.7%</td>
</tr>
<tr>
<td>Total</td>
<td>9910</td>
<td>959</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Reduction of Length of stay in elective surgery

Median length of post-operative stay, 1998-2008, by category

- Hip prosthesis
- Knee prosthesis
- Hip hemiarthroplasty
Time to infection
July 2008 - March 2010

Hip & Knee prosthesis
Post-discharge surveillance for categories with short length of stay

• Particularly important for categories with short LOS

• Active surveillance methods will identify more infections – better sensitivity of case-finding

• PDS can be resource intensive

• PDS should be systematically applied to all patients discharged from hospital

• High completion rates are needed to have confidence in the data
The value of post-discharge surveillance - readmission data Apr 2007- Mar 2012

Trends in rates of SSI in orthopaedic categories
NHS Trusts in England

Monitoring surgical wounds for infection

Information for patients

Patient information leaflet available from
ssi.data@phe.gov.uk

This leaflet explains surgical wound infection and the national programme for monitoring infections acquired in hospitals.
Reducing surgical site infection following caesarean section


Abstract

Aim To set up a surgical site infection (SSI) benchmark rate for caesarean sections and improve infection rates by monitoring and implementing compliance with the guidelines produced by the National Institute for Health and Clinical Excellence (NICE).

Method A total of 2,382 patients who had undergone caesarean section at Maidstone and Tunbridge Wells NHS Trust were monitored at two obstetric sites over a two-year period. A proactive infection surveillance system was used during the patients’ hospital stay. Community midwives collected and returned post-discharge data on wound status. Patients were asked to return post-operative questionnaires 30 days after surgery, providing details of any wound problems. Compliance with NICE guidance on reducing SSIs was measured at both sites and changes were implemented accordingly.

Results Infection rates before compliance with NICE guidance from July 2008 to June 2009 ranged from 5.7% to 9.0%. After introducing the guidelines, rates of SSI at site A and site B were reduced by 3.3% and 3.8% respectively. Rates of SSI at site A were reduced further to 1.3% on introduction of the hydrofiber and hydrocolloid dressing.

Conclusion Results suggest that the hydrofiber and hydrocolloid combination dressing assists in the reduction of SSI rates following caesarean section when used in combination with the NICE guidance.
Using surveillance to change clinical practice – Hospital [a] (example 1)

initial audit of patient journey did not identify specific problems but resulted in increased awareness of IC:

- hand hygiene
- surgical practice
- antimicrobial prophylaxis
- wound management
using surveillance to change clinical practice – Trust [z] (example 2)

series of measures implemented:
- senior clinicians assess SSI
- alternative dressings
- use of laminar flow
- timing of antibiotic prophylaxis
Identifying Outliers

Combined inpatient & readmission rate for each hospital reviewed every quarter.

Hospitals can work out their outlier status by looking at the benchmark and box plot

1. Reports with unusually high or low rates – standard outlier report letter sent to surveillance and report contacts at the hospital and copied to HCAI leads from the local health protection teams from Public Health England.

2. Hospitals are expected to respond in writing acknowledging their outlier status and outlining measures they intend to take to address the situation.

3. Assistance is available to hospitals either through discussions over the phone or hospitals can be visited by Surveillance manager and Epidemiologist from SSISS
Hospital variation in SSI incidence
April 2008-March 2013

### Table 3.1. Number of reported operations by country and type of operation, 2010–2011

<table>
<thead>
<tr>
<th>Country</th>
<th>CABG</th>
<th>CHOL</th>
<th>COLO</th>
<th>CSEC</th>
<th>HPRO</th>
<th>KPRO</th>
<th>LAM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient-based data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>586</td>
<td>840</td>
<td>507</td>
<td>6803</td>
<td>9542</td>
<td>597</td>
<td>0</td>
<td>18875</td>
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<tr>
<td>Finland</td>
<td>10788</td>
<td>8557</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>19345</td>
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<td>France</td>
<td>2236</td>
<td>28427</td>
<td>13315</td>
<td>37969</td>
<td>50503</td>
<td>26946</td>
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<td>28770</td>
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<td>370</td>
<td>3247</td>
<td>659</td>
<td>4998</td>
<td>1089</td>
<td>236</td>
<td>290</td>
<td>10889</td>
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<td>8842</td>
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<td>2997</td>
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<td>Lithuania</td>
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<td>4393</td>
<td>1221</td>
<td>848</td>
<td>0</td>
<td>10404</td>
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<td>Malta</td>
<td>451</td>
<td></td>
<td></td>
<td>493</td>
<td>236</td>
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<td>1180</td>
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<td>Netherlands</td>
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<td>4604</td>
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<td>1178</td>
<td>47502</td>
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<td>Norway</td>
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<td>4709</td>
<td>5168</td>
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<td>Portugal</td>
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<td>3344</td>
<td>1719</td>
<td>1213</td>
<td>128</td>
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<td>Slovakia</td>
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Public Health England
PHE Research & Development

- Surveillance category priority survey of NHS hospitals
- Antibiotic Prophylactic Re-dosing in colorectal Surgery
- Redesign of the SSI database
- Economic burden of SSI following C-section
- Using evidence to reduce risk of healthcare acquired infections following primary hip replacement
- Changes in the microbial aetiology of SSI over time
- The risk of developing surgical site infection in patients suffering from Diabetes mellitus undergoing surgery
- Lecturing at Universities on Infection Control and Public Health Programs
References


