REPORT

Recommendations for a National Surgical and Procedural Site Infection Surveillance Programme

15 March 2010
Table of Contents

Table of Contents .............................................................................................................................. 2
Executive Summary .......................................................................................................................... 5
1 Introduction ............................................................................................................................. 7
   1.1 Proposal ................................................................. 7
   1.2 Purpose of this report .................................................... 7
   1.3 Background to the SSI Surveillance Project ......................... 7
   1.4 How were the recommendations developed? ......................... 8
   1.5 Consultation outcomes .................................................. 8
2 The case for change .............................................................................................................10
   2.1 Health sector costs of SSI ................................................. 10
   2.2 The cost to patients of SSI ............................................... 11
   2.3 Cost and benefits of a SSI surveillance programme .................. 11
3 Recommendations ................................................................................................................13
   3.1 Definitions of SSI ............................................................ 13
       3.1.1 Recommendation ................................................... 13
       3.1.2 Consultation feedback .............................................. 13
       3.1.3 Background and rationale ......................................... 13
   3.2 Procedures for surveillance ............................................... 15
       3.2.1 Recommendations ................................................... 15
       3.2.2 Consultation feedback .............................................. 15
       3.2.3 Background and rationale ......................................... 16
   3.3 Approach to surveillance .................................................. 16
       3.3.1 Recommendations ................................................... 16
       3.3.2 Consultation feedback .............................................. 16
       3.3.3 Background and rationale ......................................... 17
   3.4 Surveillance methods ......................................................... 18
       3.4.1 Recommendations ................................................... 18
       3.4.2 Consultation feedback .............................................. 19
       3.4.3 Background and rationale ......................................... 19
   3.5 What data should be collected? ............................................. 20
       3.5.1 Recommendations ................................................... 20
       3.5.2 Consultation feedback .............................................. 21
       3.5.3 Background and rationale ......................................... 21
3.6 ‘How’ to monitor for event? ..........................................................22

3.6.1 Recommendations ....................................................................22
3.6.2 Consultation feedback ...............................................................22
3.6.3 Background and rationale .........................................................22

3.7 Risk stratification .........................................................................25

3.7.1 Recommendations ....................................................................25
3.7.2 Consultation feedback ...............................................................25
3.7.3 Background and rationale .........................................................26

3.8 Rate (risk) calculations .................................................................28

3.8.1 Recommendations ....................................................................28
3.8.2 Consultation feedback ...............................................................28
3.8.3 Background and rationale .........................................................28

3.9 Reporting ....................................................................................29

3.9.1 Recommendations ....................................................................29
3.9.2 Consultation feedback ...............................................................29
3.9.3 Background and rationale .........................................................29

3.10 How to deliver a national SSI surveillance programme? ....................31

3.10.1 Recommendations ....................................................................31
3.10.2 Consultation feedback ...............................................................31
3.10.3 Background and rationale .........................................................31

3.11 Sustainability .............................................................................34

3.11.1 Recommendations ....................................................................34
3.11.2 Consultation feedback ...............................................................34
3.11.3 Background and rationale .........................................................34

4 Conclusion ....................................................................................36

5 Appendix 1: Abbreviations and definitions ........................................37

6 Appendix 2: Health and Disability Commissioners Submission ................39

7 Appendix 3: Summary of consultation feedback and project team response ......40

8 Appendix 4: Summary of approaches to SSI surveillance ........................53

8.1 United States ..................................................................................53
8.2 England .........................................................................................54
8.3 Scotland .........................................................................................54
8.4 Australia .......................................................................................54
8.5 New Zealand ..................................................................................55

9 Appendix 5: NHSN definitions of SSI ............................................61

9.1 Definition of superficial incisional SSI ..........................................61
9.2 Definition of deep incisional SSI ...................................................62
9.3 Definition of organ/space SSI .......................................................62
Executive Summary

This document presents recommendations to the Ministry of Health (the Ministry) for the development of a consistent, evidence-based approach to surveillance of surgical and procedural site infections (SSI) in New Zealand. Such surveillance is expected to contribute to and inform actions that will deliver health and economic benefits for both patients and hospitals. Surveillance will provide hospitals with information to guide clinical practice to enhance patient safety and free up resources for other healthcare activities.

This document outlines why New Zealand needs a national SSI surveillance programme and provides background and a rationale to support each recommendation made.

This document was developed, as part of the National Quality Improvement Programme (NQIP), by a multidisciplinary project team. The recommendations have been informed by international and national experience in SSI surveillance and apply to all surgery funded by District Health Boards (DHBs) regardless of which facility carries out the surgery.

In summary, it is recommended that a national SSI surveillance programme in New Zealand be based on the following approach:

• the programme uses the US National Healthcare Safety Network (NHSN) definitions for SSI
• selected hip and knee surgeries be the initial procedures targeted for surveillance
• over time additional procedures (such as coronary artery bypass grafting (CABG) and caesarean sections) should also be targeted for surveillance
• a staged approach be used to implement the surveillance
• continuous surveillance of all selected procedures be performed
• monitoring for event should occur in a standardised, systematic and prospective manner
• data collection is automated and efficient
• data be collected on compliance with important aspects of surgical best practice (eg, administration of prophylactic antibiotic in the hour prior to surgery)
• designated healthcare professionals (eg, infection control professionals) collect and submit data for SSI surveillance and are trained to undertake this role
• a minimum approach to SSI case finding is based on scanning relevant microbiology requests and readmissions to hospital among patients who have undergone a procedure of interest
• the NNIS risk index is used to adjust for case mix between hospitals
• DHBs are able to generate their own reports from submitted data
• an annual report for all participating DHBs is publically issued
• the programme meets the current New Zealand Standard for Infection Prevention and Control and is centrally coordinated with ongoing national oversight, governance and leadership

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1 The Centers for Disease Control and Prevention (CDC) consider an infection to be an SSI when it occurs at the site of surgery within 30 days of an operation or within one year of an operation if a foreign body (eg, an artificial heart valve or joint) is implanted as part of the surgery (http://www.cdc.gov/ncidod/dhqp/FAQ_SSI.html)

2 NQIP is one of the programmes initiated by QIC, implemented by DHBs and overseen by the Ministry of Health. More information on QIC and NQIP can be found on the QIC website www.qic.health.govt.nz
• there is national commitment to ongoing training, education and research into SSI in New Zealand and support for DHB staff undertaking surveillance activities
• DHBs and other stakeholders are informed about why this surveillance is essential
• there is strong commitment to ensuring sustainable structures and funding arrangements are in place to successfully run a SSI surveillance programme long-term
• the programme will incorporate information technology to reduce the labour-intensive aspects of surveillance.

The outputs from the proposed surveillance programme will allow hospitals to make meaningful comparisons between local incidence rates and national benchmarks. These comparisons should direct and motivate hospitals to reduce rates of SSI by making changes to surgical care practices, including by implementing ‘bundles’ of best healthcare practice.
1 Introduction

1.1 Proposal

This report proposes the development of a national SSI surveillance programme to identify and measure SSI events to help inform quality improvement initiatives. The outcome of such a surveillance programme will be to provide hospitals with information to guide clinical practice improvements and free up resources for other healthcare activities.

1.2 Purpose of this report

The purpose of this report is to:

- provide background information on SSI surveillance
- describe the approach taken to developing recommendations for a national SSI surveillance programme
- demonstrate why a national SSI surveillance programme is needed (‘the case for change’)
- present to the Ministry recommendations for a national SSI surveillance system, along with the supporting rationale.

1.3 Background to the SSI Surveillance Project

Internationally it is recognised that up to 10 percent of patients admitted to hospitals in the developed world acquire one or more infections during their time in hospital. (Controller and Auditor General Office, 2003) These infections contribute to patient mortality, morbidity and divert scarce health resources away from other priority areas.

To address this significant problem, the Quality Improvement Committee (QIC) developed NQIP, which includes a programme for improving the prevention and control of infections in health care facilities – the Infection Prevention and Control (IPC) Programme.

The SSI Surveillance Project is one of the three components of IPC\(^3\). This project provides an opportunity to develop a consistent, evidence-based approach nationally to the surveillance of SSI. In turn, this contributes to national and international efforts to improve the safety of patients, healthcare workers and wider communities by reducing healthcare-acquired infections (HAI).

The SSI Surveillance Project builds on substantial international experience in reducing HAI. Surveillance of infections is one of the most important functions of a hospital infection control programme. Surveillance, with prompt feedback of data to surgical services, can result in

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\(^3\) The other two IPC projects address hand hygiene and catheter-related bloodstream infections. More information about the IPC projects can be found at [www.infectioncontrol.org.nz](http://www.infectioncontrol.org.nz)
reductions in infection rates. In addition, reporting of risk-adjusted, procedure-specific infection rates is a measure of the quality of care.

1.4 How were the recommendations developed?

This report was drafted by a multidisciplinary project team with members drawn from different DHBs, the Ministry and independent project management support. Garry Smith, Auckland DHB Chief Executive, had lead responsibility for this national project.

In developing the recommendations for a national SSI surveillance programme and the supporting rationale, the project team identified and reviewed relevant literature, policies and strategies, and considered current New Zealand and international practices. A consensus-based approach was taken and members of a Technical Reference Group supported this work by peer reviewing material developed by the Team. Consultation with a wide range of stakeholders was undertaken on the draft recommendations (consultation outcomes are outlined below).

1.5 Consultation outcomes

In October/November 2009 consultation was undertaken with a range of stakeholder groups who will either have an impact on, or will be impacted by, a national system for SSI surveillance. All DHBs and stakeholder groups with varying interests in SSI surveillance were invited to comment on a consultation document setting out the draft recommendations. Those who were invited to comment included:

- medical practitioner organisations (eg, organisations representing surgeons, nurses and microbiologists)
- other health professional bodies (eg, infection control networks, medical specialty colleges and societies, and consumer representatives)
- SSI managerial stakeholders (eg, national chief medical officers and the public health national collective).

Thirty two written responses were received. Overall, while there were suggestions for refinement and some queries indicating a need to further develop or clarify some recommendations, there was overwhelming support for the recommended approach. An example of the support is the response from Ron Paterson, Health and Disability Commissioner, who strongly supports all the recommendations made in document and gave congratulations on producing such a clear and comprehensive consultation document. A copy of the Commissioner’s submission can be found in appendix 2.

Examples of the tenor of other supportive comments received are as follows:

- firmly support the intention, principle and direction of this national programme
- overall this seems to be a rational, well thought out proposal
- need a SSI surveillance programme as it is a crucial measure of the quality of care delivered and can trigger many service improvement initiatives
- think the document is good – agree with most of it
- supportive of this document and wish to continue having involvement with this project as it moves forward
- support the proposal in principle
- glad to see this underway.
Consultation feedback helped to identify any issues and amendments needed. In the end, only relatively minor amendments were required to the original draft recommendations. A brief summary of the consultation feedback is contained in section 3 after each set of recommendations. Where appropriate, the feedback summary is accompanied by the project team’s response. Further information on the feedback and project team responses can be found in appendix 3.

Key overarching issues raised during consultation was the submitters’ concern that any SSI surveillance programme be properly resourced and the importance of electronic data collection and management as part of any such programme. The project team noted, however, that these are issues that would best be considered in depth as part of the implementation phase.
2 The case for change

A national SSI surveillance programme is expected to contribute to the achievement of significant health and economic benefits for both patients and hospitals.

In 1970, the landmark ‘Study on the Efficacy of Nosocomial Infection Control’ (SENIC) demonstrated the value of infection control measures in reducing HAIs. (Haley, Culver, White, et al, 1985) The SENIC study showed that well-organised surveillance that includes feedback of infection rates to surgeons was associated with a significant reduction in the incidence of SSI.

The June 2003 report ‘Management of Hospital-acquired Infection’ (Controller and Auditor General Office, 2003) noted that, internationally, up to 10 percent of patients admitted to modern hospitals in the developed world acquire one or more infections. This is significant in terms of avoidable patient mortality and morbidity, occupational risks to healthcare workers and health risks to the wider community. In 2003, it was estimated that the annual cost of such infections in New Zealand could be almost $140 million. (Graves, Nicolls, & Morris, 2003)

SSI are the second most common HAI after infections of the urinary tract – they account for approximately 17 percent of all HAI and occur in two to five percent of patients undergoing surgical procedures. (Roy, 2003) Reducing SSI is a priority due to the health and economic burden that result from these infections.

2.1 Health sector costs of SSI

The exact costs of HAI, including SSI, are difficult to measure and value. The greatest cost of HAI to the health sector is related to the additional length of stay that occurs as a consequence of the infection (ie, due to the consumption of healthcare resources that would otherwise be available to other patients). SSI prolong the patient’s hospital stay on average by 7.4 days, at an average cost of $1000 per day. (Roy, 2003) This is a significant ‘opportunity cost’.

Therefore, the process of attributing cost of HAI is best couched in terms of the number of bed days that are released and additional variable costs avoided.

Table one compares the cost for specific HAI including the limited data available from New Zealand. It illustrates the substantial cost associated with HAI and the variation in cost depending on type of HAI.

The information contained in table one demonstrates that significant, unnecessary consumption of healthcare resources can be avoided by preventing infections – effective infection prevention frees up bed days and reduces expenditure on variable costs such as laboratory and radiological testing, pharmaceuticals and dressings. With high occupancy in most hospitals, lack of available beds results in elective procedures being cancelled and may contribute to DHBs not meeting service contracts.
Table One: Cost and increased length of stay associated with HAI

<table>
<thead>
<tr>
<th>Study Year (Author)</th>
<th>Type of Study</th>
<th>Country</th>
<th>Type of HAI (number of patients)</th>
<th>Increased length of stay (days)</th>
<th>Excess cost per episode of infection (approximate NZ$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001 (Pirson, et al., 2005)</td>
<td>Case-control</td>
<td>Belgium</td>
<td>Bloodstream infection (44)</td>
<td>21</td>
<td>€12,853 ($22,500)</td>
</tr>
<tr>
<td>2002 (Orsi, et al., 2002)</td>
<td>Case-control</td>
<td>Italy</td>
<td>Bloodstream infection (105)</td>
<td>19</td>
<td>€16,356 ($28,835)</td>
</tr>
<tr>
<td>2002 (Whitehouse, et al., 2002)</td>
<td>Case-control</td>
<td>USA</td>
<td>SSI (Ortho) (59)</td>
<td>15</td>
<td>$US17,708 ($25,400)</td>
</tr>
<tr>
<td>2002 (Tambyah, Knasinski, &amp; Maki, 2002)</td>
<td>Prospective observational</td>
<td>USA</td>
<td>Urinary tract (235)</td>
<td>(Not reported)</td>
<td>$US589 ($844)</td>
</tr>
<tr>
<td>2005 (Sheng, et al., 2005)</td>
<td>Case-control</td>
<td>Taiwan</td>
<td>All HAI</td>
<td>20</td>
<td>$US5000 ($7100)</td>
</tr>
<tr>
<td>2005 (Upton, Smith, &amp; Roberts, 2005)</td>
<td>Case-control</td>
<td>NZ</td>
<td>SSI (Cardiothoracic)</td>
<td>32</td>
<td>$46,000</td>
</tr>
<tr>
<td>2007 (Burns)*</td>
<td>Case-control</td>
<td>NZ</td>
<td>Bloodstream infection</td>
<td>10</td>
<td>$20,500</td>
</tr>
<tr>
<td>2007-8** Based on VICNISS</td>
<td></td>
<td>Western Australia</td>
<td>SSI (Hip and knee arthroplasty) (85)</td>
<td>27</td>
<td>Hip $40,940 ($51,000) Knee $34,138 ($43,000)</td>
</tr>
</tbody>
</table>

* Unpublished data, ADHB  

2.2 The cost to patients of SSI

The cost to patients resulting from SSI is personal as well as financial (note that the information in the previous section does not include any financial costs incurred by patients). The psychological impact of a prolonged recovery and reduced quality of life, as well as the loss of income and sense of wellbeing (associated with delays in returning to employment and other usual activities) are significant considerations. Other hidden costs, such as those relating to the extra assistance required in the home environment, assistance with attending medical appointments and ongoing treatments are also acknowledged.

Most studies looking at the excess cost of SSI have not assessed these patient-specific costs as it is difficult to obtain data and assign dollar values. (Herwaldt, et al., 2006)

2.3 Cost and benefits of a SSI surveillance programme

A significant benefit of an SSI surveillance programme is the improvement in patient safety resulting from reduced infection risk. Where baseline rates of SSI are low, infection control services can focus on other important work such as hand hygiene or antibiotic stewardship. Where rates are high, auditing of clinical practice may be carried out and the implementation of scientifically established interventions to reduce infection rates can be applied as with the Surgical Care Improvement Programme (SCIP).

It is recognised that a programme, such as that recommended in this document, will result in additional costs for individual DHBs. These costs include the time spent by staff undertaking surveillance, audits, training and education and IT services. The provision of accurate rates of SSI will allow for estimates of the cost associated with these infections and the estimated costs avoided when SSI are prevented. The costs avoided may allow for additional funding to be provided for other effective infection and prevention initiatives and other healthcare activities.
Aside from costs avoided, other major benefits of implementing a national SSI surveillance programme would include:

- bringing New Zealand into line with many other developed countries (eg, Australia, England, Scotland, USA, Netherlands, and Germany) which have state or national SSI projects that have largely been successful in reducing SSI rates. International approaches to SSI surveillance are summarised in appendix 4

- allowing SSI rates to be compared between and within DHBs, increasing DHB accountability

- the ability to audit the risk factor data collected (eg, antimicrobial prophylaxis) against best practice, so it can be used as a performance indicator

- the ability for the programme to become part of the quality assurance programme for surgeons, rather than another add-on

- the ability to use the database generated for epidemiological research projects with minimal additional cost.
3 Recommendations

The following section presents the project team’s recommendations for a national SSI surveillance programme. Background information on the issues is provided along with the rationale behind each of the associated recommendations. Also included is a brief summary of consultation feedback on the original draft recommendations and, where appropriate, the project team’s response to the feedback.

In developing the recommendations, the project team assumed that SSI surveillance will be consistent nationally and deliverable across all DHBs.

It is important to note that:

- the recommendations capture all surgery funded by DHBs regardless of which facility carries this out
- implementation of the recommendations was outside the scope of the project (ie, beyond being satisfied that the recommendations are reasonably practicable and, as far as possible, cost-effective).

3.1 Definitions of SSI

3.1.1 Recommendation

That the SSI surveillance programme utilise the National Healthcare Safety Network (NHSN)\(^4\) definitions.

3.1.2 Consultation feedback

There was overwhelming support for using the NHSN definitions from submitters. It was noted that the NHSN definitions are internationally recognised and will allow standardisation across New Zealand, as well as comparison both locally and nationally.

3.1.3 Background and rationale

In 1992 a consensus group from the Association of Professionals in Infection Control and Epidemiology (APIC), the Society for Healthcare Epidemiologists (SHEA) and the Surgical Infection Society adopted the term surgical site infection to describe the layers of tissue that were involved in an infectious process.

\(^4\) Previously known as the National Nosocomial Infection Surveillance.
The Centers for Disease Control and Prevention (CDC) in the USA developed the NHSN\(^{16}\) definitions for SSI. (Horan, et al., 1992; Mangram, et al., 1999) They classify SSI into three levels:

1. **superficial incisional SSI** which involves skin and subcutaneous tissue

2. **deep incisional SSI** which involves deeper soft tissue

3. **organ/space SSI** which involve any part of the anatomy (organs and spaces), other than the incision, opened or manipulated during operations.

These definitions have allowed the standardisation of SSI and they, or minor variations of them, are used by most SSI surveillance programmes internationally. More detail on each of the above three definitions of SSI can be found in appendix 5.

The definitions come with an explanation about their application. There is guidance given around the clinical diagnosis of SSI, including:

- the requirement for clinical signs of infection to be documented in clinical notes
- the need for microbiology results to be interpreted in conjunction with the clinical findings.

NHSN definitions have strict guidelines to ensure that each participant can adhere to the same criteria which promotes consistency in defining each type of SSI.

To assist surveillance personnel in making decisions consistently, each module in the manual contains a list of specific infection sites and the criteria for determining the presence of an infection at each of those specific sites.

Participants in a surveillance programme may not agree with all of the criteria for the NHSN definitions, but it is imperative to routinely use them for reporting infections. This will then allow the rates between hospitals to be more accurately compared and/or bench-marked.

The NHSN definitions are a well validated set of definitions which are used widely internationally. To collect useful data nationally, it is essential to have standard definitions used by all DHBs. Training will need to be provided to ensure that the application of the definitions is nationally consistent.
3.2 Procedures for surveillance

3.2.1 Recommendations

That the NHSN operative procedure categories be used to define procedure categories (see appendix 6).

That the surgical procedure categories are introduced to the national surveillance programme in a staged approach:

1) first stage
   - hip prosthesis (including revision surgery)
   - knee prosthesis (including revision surgery)

2) second stage
   - caesarean section
   - coronary artery bypass graft (CABG)

3) third stage
   - further operative procedure categories selected from Appendix 6 (eg, vascular) that best fulfil the rationale outlined below.

That the procedures for surveillance include both non-emergency and emergency surgery, which will be differentiated.

That the staged approach be introduced over a period of 3-5 years to allow ample opportunity for review and that consultation occur prior to implementation of each stage to agree procedure categories to be surveyed.

3.2.2 Consultation feedback

All submitters supported a staged approach to the implementation of the programme. In support of this, one submitter noted that this would ‘enable processes to be modified and information technology to be refined which should then permit the relatively easy collection of data to minimise compliance costs’. To ensure correct operational processes and procedures are in place from the outset, it was considered that IT and education packages could be piloted to ensure they meet user needs.

As a result of feedback, the recommendations have been amended to clarify non-emergency and emergency surgery and timeframes have been proposed for the staged approach. The project team agreed that 3-5 years for the full implementation of this programme was realistic and would provide ample opportunity for review.

The majority of submitters supported the surgical procedures recommended for each stage of the programme. The project team has incorporated the submitters’ proposal that consultation should take place prior to implementation of each stage to agree the procedure categories to be surveyed.
3.2.3 Background and rationale

When choosing which surgical procedures to initially perform surveillance on, the following issues have been considered.

- **Number of procedures performed:** Data from the USA and UK show that the most commonly and consistently performed surgical procedures include hip and knee arthroplasties and caesarean sections. It is likely that these are also the most commonly performed procedures in New Zealand. Data from the National Joint Registry showed that in 2008 there were 8036 hip arthroplasties and 6002 knee arthroplasties performed in New Zealand.

- **Current surveillance:** In a recent survey of the range of SSI surveillance in the 21 DHBs, 12 reported that they undertook surveillance for joint replacement procedures, 12 for lower segment caesarean section, and five and four DHB's, respectively, undertook surveillance of clean surgical and clean contaminated procedures not otherwise specified. One DHB undertook SSI surveillance for CABG (with donor).

- **Impact of SSI:** Procedures have been chosen where the impact of SSI on the patient is significant and the cost of managing such an infection is high. This applies particularly to orthopaedic procedures where a prosthesis is inserted. A recent paper in the medical literature examined in depth the adverse impact from SSI in a range of surgical categories. It demonstrated that delay in discharge and associated costs were particularly marked for infections of hip and knee arthroplasties (deep infections) and CABGs. (Coello, et al., 2005)

- **Coverage of all DHBs:** The procedures chosen for the first stage allow all DHBs to participate.

A staged approach is recommended so that any logistical issues arising from the first stage can be addressed before the range of surveillance procedures is extended.

3.3 Approach to surveillance

3.3.1 Recommendations

That continuous surveillance be performed on each of the selected procedures.

That statistical advice is sought prior to the implementation of each stage to agree that continuous surveillance is appropriate for the procedure categories to be surveyed.

3.3.2 Consultation feedback

The recommendation contained in the consultation paper for ‘approach to surveillance’ was for SSI surveillance be performed on a minimum of 100 of each of the selected procedures, with DHBs who perform less than 100 of such procedures per year undertaking continuous surveillance, and those DHBs performing greater than 100 of a procedure per year being able to chose to undertake intermittent surveillance and report on 100 consecutive procedures.
Almost all submitters agreed or partially agreed that surveillance should be performed on a minimum of 100 procedures. Some submitters were concerned that 100 may not be enough to enable useful comparisons to be made between DHBs and down to operator level, eg, a particular surgeon may not be audited to the same extent as another due to leave, cancellation of surgery etc for that surveillance period.

Two submitters disagreed with the approach, both proposing that a larger number be sampled. One noted that ‘given the relatively low numbers of procedures and the known low incidence of infection, recommend that all patients be included in the surveillance. There is an expectation that all surgeons will participate in audit activity with ongoing peer review. Regular review of SSI is an expected part of such audit activity and should be maintained for each surgical procedure. Given that this data should be collected for all patients in respect to surgical audit there would be no additional compliance cost in providing this information as part of the national surveillance programme. Collecting data on all patients will enable an improved statistical analysis particularly when the deep infection rate is known to be low’.

Subsequent to the consultation, specialist statistical advice has been obtained from Statistics Research Associated Limited to ensure that the proposed approach is statistically sound and will allow comparison at DHB, hospital and surgical practitioner levels. As a result, the recommendations have been amended to recommend continuous surveillance of each of the selected procedures and that consultation occur prior to implementation of each stage to ensure that this approach is appropriate for the procedure categories to be surveyed.

3.3.3 Background and rationale

SSI for clean and clean-contaminated procedures are uncommon events and surveillance should be performed on a reasonably large sample size to allow for comparison of SSI rates from one time period to another. Rates calculated on small numbers of events will not be precise and will be difficult to compare over time. Larger sample sizes also enable there to be a means of adjusting for case mix by risk adjustment so that inter-hospital comparison can occur.

The number of procedures required to provide a statistically valid conclusion depend on several variables, including:

1. the required level of statistical significance of the expected result
2. what is an acceptable chance of missing real events
3. the magnitude of the event under investigation
4. the amount of disease in the population.

A reasonable number of procedures are required to obtain a number that is statistically significant from which to follow trends and reach conclusions on both a DHB and surgical practitioner level.

After careful consideration of the potential sampling strategies for SSI surveillance, Statistics Research Associates Limited advised that in most cases anything other than full sampling of a surgeon’s surgical procedures (surgeon procedure) will not provide the ability to detect changes in the existing level in SSI rates. This is due to:

- the generally small number of surgical procedures of a particular type carried out by a surgeon in a year (the population count)
- SSI rates generally being 10% or less.

In practical terms, this means that where the population count of a surgeon-procedure is 200 or less, or the population count is 500 or less and the SSI rate is ≤ .02, all surgeon-procedures should be sampled.

In other cases, unless there is substantial economic cost in sampling the surgeon-procedures, it may be more cost effective to sample all procedures, because the cost of designing and administering a scheme which sampled a fraction of surgeon-procedures may be expensive, if it is to avoid bias due to seasonal effect, such as infection rates and surgeon leave.

This approach would allow measurement of SSI rates at surgical practitioner level which is where the variation in SSI takes place. However, for reasons of privacy and ease of measurement, the DHB is the level at which public reporting would take place. DHBs should have access to their own data to conduct analysis at the level of individual hospitals and operators. See section 3.9 for further details on reporting.

### 3.4 Surveillance methods

#### 3.4.1 Recommendations

That monitoring for SSI in the selected procedures should occur in a standardised, systematic and prospective manner. Surveillance will be designed to pick up the following SSI:

- infection (deep, superficial or organ/space) which occurs within 30 days of an operation when the patient is an inpatient or is readmitted to hospital
- organ/space infections occurring up to one year following implant surgery when the patient is an inpatient or is readmitted to hospital.

That surveillance will occur according to a standard protocol (please see section 3.6 for more detail).

That post discharge surveillance be re-evaluated one year following implementation, and, if appropriate, post discharge surveillance methodology be developed based on findings.

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5 The CDC consider an infection to be an SSI when it occurs at the site of surgery within 30 days of an operation or within one year of an operation if a foreign body (eg, an artificial heart valve or joint) is implanted as part of the surgery (http://www.cdc.gov/ncidod/dhqp/FAQ_SSI.html)

6 Implant: a nonhuman-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 mechanical heart values, metal rods, mesh, sternal wires, screws, cement, and other devices.
3.4.2 Consultation feedback

The majority of submitters supported the proposed surveillance methods and one submitter noted that these are consistent with approaches taken internationally. Two submitters noted that a robust system for capturing readmissions was needed as coding for readmissions is not always accurate and difficulties arose if the patient was readmitted to another hospital.

Submitters were split as to whether post discharge surveillance should be delayed and re-evaluated at a later date or introduced in the first stage.

Those who supported not undertaking post discharge surveillance immediately and reviewing at a later date outlined issues such as the resourcing, logistics and mechanics of post discharge surveillance. They agreed that post discharge surveillance was very difficult to undertake and is problematic and resource intensive. One submitter noted that 'Post-discharge surveillance would add significant additional compliance costs but without substantial benefit. Those superficial postoperative infections which are recognised and treated in the community are likely to result in mild inconvenience and relatively low cost (reflecting an additional medical consultation and pharmaceutical costs). Patients with any more serious infection will represent or be referred back to the surgical service and thereby captured as an episode of a significant infection'.

However, it was recognised that post discharge surveillance would help provide a more 'complete' picture of SSI. There was concern that too many superficial infections would be missed and could impact on the validity of the data collected.

Given the consultation feedback and the rationale outlined below, the project team agreed that post discharge surveillance should be re-evaluated one year after implementation of the SSI surveillance programme. In the meanwhile, DHBs can chose to continue or commence their own approach to post discharge surveillance, but the results would probably not be nationally comparable.

3.4.3 Background and rationale

While rigorous post discharge surveillance (PDS) is an important element in detecting all SSI, a significant limitation is that there is currently no reliable method of identifying infections post discharge. Most countries with a SSI surveillance programme do not currently undertake post discharge surveillance (see appendix 4). NHSN in the US and SSISS in England are currently looking at this issue and a well standardised approach may eventually be developed that can be validated and implemented in New Zealand.

Serious infections that occur after discharge often lead to readmission and these infections will be captured by the proposed approach.

While restricting the collection of SSI episodes to in-hospital infections (identified during patient stay and readmissions) will miss superficial infections that often present after discharge, for many procedures post discharge surveillance would require a lot of extra work to capture a few superficial SSI. A balance is required between the cost (dollars, people and other resources) and the additional benefit gained from a quality perspective by undertaking this activity. For some procedures, the time and effort required may be better applied elsewhere.

Organ/space infections involving implants of a graft or prosthesis (orthopaedic and vascular) represent the most severe and costly end of SSI. Surveillance up to one year after the initial procedure is necessary because organisms of low pathogenicity may be inoculated into the
deep site during surgery and only become apparent as causing infection many months after the initial procedure was carried out.

The majority of organ/space infections will be captured by the proposed approach as many of these patients will be readmitted. However, it is recognised that if a patient is readmitted to a different hospital to where the procedure took place, there needs to be a mechanism in place to inform the initial hospital that a SSI has been identified (see section 3.6).

In the absence of an acceptable and well validated method for post discharge surveillance it will be up to the individual DHB to decide whether or not the undertake this task.

3.5 What data should be collected?

3.5.1 Recommendations

That all individuals undergoing a selected surveillance procedure have a core set of pre-operative and peri-operative data collected at the time of the procedure, and only those presenting with an SSI have post-operative data collected. These data items include, but are not limited to the following:

<table>
<thead>
<tr>
<th>The following data be collected for all individuals undergoing a selected surveillance procedure</th>
<th>The following post-operative data be collected for all individuals with SSI diagnosed during original admission or readmission.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative data</td>
<td>Peri-operative data</td>
</tr>
<tr>
<td>Hospital code</td>
<td>Prophylactic antibiotic (list)</td>
</tr>
<tr>
<td>NHI number</td>
<td>Dose of prophylactic antibiotic</td>
</tr>
<tr>
<td>Age</td>
<td>Time of antibiotic administration</td>
</tr>
<tr>
<td>Sex</td>
<td>Time of any intra-operative repeat antibiotic dosing</td>
</tr>
<tr>
<td>Date of admission</td>
<td>Time of operation start (knife to skin)</td>
</tr>
<tr>
<td>Date of operation</td>
<td>Time of operation finish (skin closure)</td>
</tr>
<tr>
<td>Height</td>
<td>Skin prep (chlorhexidine/povidone-iodine)</td>
</tr>
<tr>
<td>Weight</td>
<td>Surgeon (coded)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Operator Grade</td>
</tr>
<tr>
<td>Diabetes (yes/no). If yes, oral hyperglycaemics or insulin therapy (delete as appropriate)</td>
<td>Category of procedure (list)</td>
</tr>
<tr>
<td>ASA score</td>
<td>Presentation to surgery (elective/emergency)</td>
</tr>
<tr>
<td>Current smoker (yes/no)</td>
<td>Prosthesis inserted (yes/no)</td>
</tr>
<tr>
<td>Revision (yes/no)</td>
<td>Use of antibiotic loaded cement (for prosthesis)</td>
</tr>
</tbody>
</table>

That the data set be re-evaluated prior to implementation of each stage to ensure it is appropriate for each procedure selected for surveillance.
That the method of data collection and recording will be at the discretion of individual DHBs according to the human and electronic resources at their disposal. However, clearly defined times or dates must be recorded in order that calculation of variables such as pre-operative length of stay, operating time, antibiotic to incision time is consistent across all centres.

That collection of post-operative data (ie, event monitoring) will be performed in a standardised and systematic manner (see section 3.6).

That submission of data should be electronic and may occur via web-based data entry into a centralised database or a similar IT approach.

3.5.2 Consultation feedback

While submitters were broadly supportive of the data to be collected, opinions varied. For example, one submitter noted that the proposed data set should be the minimum available, while another felt that only ASA and the length and type of surgery should be collected.

The project team considered all additions/amendments recommended by submitters and have amended the table accordingly. The final table recognises that there is a ‘core’ set of data that should be collected for all procedures, as well as procedure specific data. This list would need to be re evaluated prior to any new procedure being introduced.

Responses to an open-ended consultation question indicate that all hospitals currently have systems that collect some or all of this data, mostly using a combination of electronic and manual methods.

Submitters were also asked how data collection could be made more efficient and effective. Their responses fit under two key headings – utilising electronic data collection and human resource/training/education. The project team took these responses into account in finalising this report.

3.5.3 Background and rationale

It is recognised that the number of variables that could potentially be included in the dataset for a SSI surveillance programme is potentially very large. The 36 variables outlined in the table were selected as the:

- **pre-operative factors**, including key patient centred variables, which will be necessary for effective epidemiological analysis of the data and will allow further assessment of locally relevant risk factors for SSI

- **peri-operative variables**, including established risk factors for SSI in international studies that are amenable to modification, or proven preventive measures against SSI that are part of best practice. These variables can then be audited and assessed individually as to their specific contribution to SSI rates both locally and nationally

- **post-operative variables** related to the confirmation and detailing of SSI, as well as key variables which SSI may potentially have an effect on, for example, the length of stay in hospital. Information on causative organisms that may impact on preventive measure such as appropriate prophylactic antibiotic choices will also be collected.
The majority of data elements identified for collection encompass those which are collected by other SSI surveillance programmes (VICNISS, UK, Scotland, and USA). (Mayhall, 2004) Additional variables have been added that may be of local relevance.

Nationally consistent data must be collected to allow for comparability amongst DHBs. A certain amount of information is required on all patients undergoing studied procedures, irrespective of their surgical outcome. This provides a denominator to calculate rates of SSI and to act as controls when looking at local risk factors for the development of SSI. See section 3.6 where this is discussed in more detail.

The data collected will need to be submitted to a centralised support agency to facilitate data analysis. There are a number of electronic approaches that may be used, for example, web based entry of data. How this may happen is outside the scope of this report, however, it will need to be fully explored when implementation of the recommendations is considered.

3.6 ‘How’ to monitor for event?

3.6.1 Recommendations

That pre-existing, routinely updated hospital databases be utilised in order to maximise the efficiency of case finding and decrease workload for those involved in data collection.

That a comprehensive review of available hospital-infection surveillance software locally and internationally be undertaken to determine which of these, if any, provide an appropriate fit for the proposed SSI surveillance programme.

That automated electronic data-mining systems be identified and/or developed to streamline data collection/management.

That designated healthcare personnel (eg, infection control professionals (ICPs)) be assigned to collect and submit data for SSI surveillance in all hospitals.

That all healthcare personnel assigned to collect and submit data for SSI surveillance be trained in the application of NHSN definitions and in case-finding methodology.

3.6.2 Consultation feedback

Submitters were broadly supportive of the proposed approach on ‘how’ to monitor for an SSI event and electronic collection of data was seen as the key to success. The project team considered suggestions by submitters for alternative approaches to SSI case finding and as a result, agreed that there are three essential requirements – a flagging system for readmissions, a clinically led tagging system and a microbiological flagging system.

3.6.3 Background and rationale

Hospitals participating in a national surveillance programme should detect SSI using a systematic and standardised approach. A standardised approach is necessary to ensure that rates of SSI reported by different hospitals are able to be compared in a meaningful way.
It is also important that the approach used can reliably detect cases of SSI without creating an unreasonable workload for the personnel responsible for detecting SSI cases. It is recognised that manual data collection of SSI data is time-consuming, onerous and error-prone. Although there will always be a need to allow for recording of data collected manually, automated data collection systems offer the opportunity to alleviate much of the burden of sifting through records for candidate SSI cases. Efficient data management is vital to the success of this surveillance programme.

It is envisaged that the majority of the core data can be collected automatically from existing patient administration and laboratory systems. One method could be automated data-mining software which retrieves patient information from microbiology, pharmacy and other medical records to ensure accuracy, consistency and ease of data collection and management.

Wherever possible, surveillance systems will need to be simple in design and use routinely available data, recognising the need to reduce the amount of time required to collect surveillance data and allowing hospitals to focus on infection prevention rather than poring through mountains of paperwork. It will also be important to avoid re-inventing the wheel at each institution, thereby avoiding unnecessary additional expense.

The options for automated identification of SSI and for extracting and interfacing this data to the consolidated database are varied and are highly dependent on the specifics of the local organisation’s IT systems. Software may need to be tailored for each hospital to ensure correct data is retrieved.

There are a variety of approaches to establishing a system to manage SSI surveillance, ranging from simple spreadsheet consolidation with manual case identification to MS Access databases through to centralized Internet-facing datastores with sophisticated data mining extracts and automated interfaces. Key factors influencing the decision on approach will include: cost (start-up and ongoing), resource-requirements and time to implement, and type of systems in use.

Although there is nothing that necessarily precludes starting with a simple spreadsheet approach, this is not likely to be viable long-term as the number of procedures being reported and data volumes increase. The table below outlines some of the considerations and issues with different approaches.

<table>
<thead>
<tr>
<th>Options for Data Collection/Consolidation</th>
<th>Spreadsheets</th>
<th>Database (e.g. MS Access)</th>
<th>Website Purpose-built</th>
<th>Website Vendor-solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Startup Development/Purchase</td>
<td>Low</td>
<td>Relatively Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Speed of Initial Implementation</td>
<td>Fast</td>
<td>Quite Fast</td>
<td>Slow</td>
<td>Medium</td>
</tr>
<tr>
<td>Scalability</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Data Integrity</td>
<td>Low&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Good</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Data Immediacy/Timeliness</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Concurrent Usage/Availability</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Ongoing effort for consolidation</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

<sup>1</sup>: Potential inconsistencies between local and central copies → Data reconciliation issues

An additional alternative to be considered may be to link into a pre-existing secure, internet-based surveillance system. As an example, CDC may be willing to consult with other countries who are interested in utilizing NHSN.
A comprehensive review of available hospital-infection surveillance software locally and internationally will need to be undertaken to determine which of these, if any, provide an appropriate fit.

The detection of SSI should be performed by trained personnel. This will require a collaborative effort between key services (e.g., surgical services and infection prevention control personnel).

In most DHBs, retrieval, analysis and reporting of SSI data is undertaken by the Infection Control Service. It is the role of all key personnel (clinical and ICP) to ensure that all procedures undertaken during the surveillance period are captured (‘denominator data’). For example, clinicians will participate in SSI monitoring by ensuring relevant information required in the data set is entered into electronic records (preferably) or paper records. In addition, ICPs should use a systematic and standardised approach to detect cases of SSI (‘numerator data’).

### 3.6.3.1 Collection of denominator data (all patients undergoing procedure)

All patients who have undergone a procedure of interest during the surveillance period should be recorded using a standardised data collection tool (see appendix 7 for examples) – this provides the denominator data. This should be electronic rather than paper based.

It is important that denominator data is collected from all patients undergoing a procedure of interest, especially in the initial stages of surveillance, to be able to identify what puts patients at risk of a SSI. With time, the amount and type of data collected should be reviewed to confirm whether this level of information is still necessary.

Wherever possible, to reduce workload, the pre-operative and peri-operative data outlined in section 3.5 should be obtained from pre-existing hospital databases. Collaboration with national surgical registries should also be pursued in order to avoid unnecessary duplication of data collection (e.g., the National Joint Registry (NJR)). Designated ICPs at each participating hospital should liaise closely with IT staff so that pre-existing hospital databases are utilised effectively.

### 3.6.3.2 Collection of numerator data (SSI case finding)

Traditional methods used to detect cases of SSI include the following:

- systematic review of patient charts, including medical notes and temperature charts
- ward-based reporting by the clinical team caring for the patient
- systematic review of databases, including those maintained by microbiology, pharmacy and radiology departments.

Systematic, manual review of patient charts by those responsible for collecting data can be impractical if large numbers of patients need to be followed up. Ward-based reporting of SSI by the team caring for the patient is also problematic.

Identification of cases of SSI using microbiology, readmission and other relevant databases to flag patients with possible SSI is proposed. This simple approach is likely to be feasible as a minimum SSI case finding strategy for most hospitals in New Zealand.
If the patient meets NHSN criteria for SSI but the procedure itself was performed at a different hospital, then the ICP at the hospital where the operation was originally performed should be notified.

**Microbiology request surveillance**

Surgical patients who have relevant specimen (eg, aseptically obtained culture of fluid or tissue from the incision) submitted to the microbiology laboratory should be identified to determine whether they have undergone a procedure targeted for surveillance within the preceding 30 days (or within the previous year if the targeted procedure involved an implant). Ideally the specimen will be tagged, allowing for electronic flagging of results. Hospital IT staff may be able to assist with this process.

If the patient has undergone a targeted procedure within this timeframe, then the clinical records should be reviewed to determine whether NHSN criteria for SSI are met.

For hospitals that perform fewer procedures, it may be feasible to regularly review the microbiology records of each individual patient without obtaining a separate list from IT and/or microbiology.

**Readmission surveillance**

Hospital databases should be used to identify all patients that have been readmitted within 30 days of discharge (or within 1 year of discharge for procedures involving implants). Those that have had a relevant surgical procedure can then be identified and reviewed to determine whether the NHSN definition for SSI has been met. Input from hospital IT staff may be required.

### 3.7 Risk stratification

#### 3.7.1 Recommendations

That the current NHSN (formerly NNIS) modified risk index should be applied.

That, in addition to the risk factors collected for the NHSN modified risk index, the collection of other risk factors should be undertaken to determine the procedure-specific risk factors in the New Zealand setting. These risk factors include, but are not limited to the following: age; gender; ethnicity; preoperative length of stay; diabetes mellitus; indication for surgery, complexity of surgery. Multivariate analysis should be undertaken to determine the importance of each risk factor for each procedure.

#### 3.7.2 Consultation feedback

The majority of submitters were supportive of the recommendation to undertake risk stratification.

There was a mixed response as to whether New Zealand specific risk factors should be determined. Around half of the submitters felt that it was important to have New Zealand
specific risk factors as evidenced by the following comment ‘every country has its own individual patient mix and it is important to determine which patient groups are more at risk’. In contrast, other submitters felt that New Zealand’s risks were no different to other western countries.

The project team considered all the responses and agreed that as the risk factor data was already being collected as part of the core data set, it should be assessed in the future as to whether it provides a benefits or not.

### 3.7.3 Background and rationale

Risk stratification is a means of adjusting for case mix. It allows for adjustment of the rate according to the risk of developing an SSI. For SSI, the traditional wound classification system, which stratifies each wound into one of four categories (clean, clean-contaminated, contaminated and dirty-infected), is limited as it fails to account for intrinsic patient risk factors.

The original SENIC Study data was used to develop a simplified risk index. Ten risk factors were analysed with stepwise multiple logistic regression techniques. The risk index was applied to a further sample of surgical patients and it was shown to be predictive of the risk of SSI. Surgical wound infection risk was best predicted by four factors:

1. abdominal surgery
2. an operation lasting longer than two hours
3. contaminated or dirty-infected operations as classified by the traditional wound classification system
4. having greater than or equal to three discharge diagnosis.

The risk index was modified in 1991 so that it was based on data easily obtainable at the time of surgery. Each operation is scored by the presence or absence of three risk factors:

1. a patient having an American Society of Anaesthesiologists (ASA) preoperative assessment score of 3, 4 or 5
2. an operation classified as either contaminated or dirty-infected
3. an operation with duration of surgery more than $T$ hours where $T$ depends on the operative procedure being performed.

The $T$ cut point for each surgical procedure was derived from the NNIS database and was chosen to be the 75th percentile of the distribution of duration of surgery for that procedure. The ASA score is a proxy variable for patient intrinsic risk. An assumption was made that these three variables account for the majority of operative risk for infection and that they are each of equal importance or weight.

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7 ASA Physical Status Classification System: P1 – a normal healthy patient; P2 – a patient with mild systemic disease; P3 – a patient with severe systemic disease; P4 – a patient with severe systemic disease that is a constant threat to life; P5 – a moribund patient who is not expected to survive without the operation; P6 – a declared brain-dead patient whose organs are being removed for donor purposes.
More recently, the finding that the use of laparoscope had a protective effect has prompted NHSN to modify its index by allowing subtraction by one to a lower category whenever a laparoscope is used.

The approach towards surgery has changed in recent years. There has been a shift towards outpatient or day surgery, the intrinsic risk factors within patient groups has increased. Patients are getting older, have more co-morbidities and may be immunocompromised and the length of stay postoperatively has reduced. It has clearly been established that certain patient and procedure specific events increase the risk for SSIs. This, coupled with recent changes to the way in which surgery is performed, has shown that the currently used NNIS modified risk index does not predict risk of infection for all procedures.

It may be more important to determine the risk factors that are unique for each procedure and then assess the importance or weight that should be given to each variable. This can only be achieved by using a standardised approach to the collection of potential risk factors and then using an aggregated multivariate model to determine risk factors.

Data from the VICNISS HAI surveillance system has shown that the NNIS risk index correlates well with some procedures (appendectomy, caesarean section and colon surgery) but correlates poorly with others such as coronary artery bypass surgery. (Freidman, et al., 2007) Other studies have applied the c-index (a measure of predictive performance) to assess the NNIS risk index to a range of surgical procedures. A population-based study showed that the modified risk index had modest discrimination only (C statistic, 0.59) and the majority of SSI occurred within lower risk strata. (Daneman, Simor, and Redelmeier, 2009)

In a multi-centre cohort study the predictive power of the NNIS modified risk index was compared with the ability of a procedure-specific logistic regression model to predict SSI. The predictive power of the newer model was better than the NNIS modified risk index at predicting the risk of SSI. (Geubbels, et al., 2006)

Similar studies looking at single procedures only, such as cardiothoracic operations, have shown that the NNIS risk index stratifies patients by one variable only – the duration of surgery. (Roy, et al., 2000)

While there is some uncertainty about the validity of the current NHSN modified risk index to stratify patients in a meaningful way for increased infection risk for all procedures, it has been used extensively by SSI programmes in other countries and should be applied for the proposed surveillance programme. However, it is clear that any risk stratification scoring system should ideally be validated in New Zealand (ie, as little is known about what factors are relevant in the local population).

Another means for stratifying for risk is by standardisation of the rate. Standardisation is a method of combining category-specific rates into a single summary value by taking the weighted average of them. Standardisation facilitates the comparisons of HAI rates over time within and between hospitals and would allow for the prediction of SSI risk for patients undergoing a particular procedure.
3.8  Rate (risk) calculations

3.8.1  Recommendations

That the rate (or risk) of SSI is reported as the number of SSI per 100 operations.

That an in-hospital rate be calculated. Where post-discharge surveillance is undertaken this rate can be reported separately and then combined with the in-hospital rate to provide a 30-day post operation/procedure rate for procedures without prosthetic implants and 12-month post operation/procedure rate for those procedures with prosthetic implants.

3.8.2  Consultation feedback

The majority of submitters were supportive of the proposal to undertake risk (rate) calculations. Two submitters suggested another approach, namely to count days since the last SSI (total and for each operation). The project team agreed that DHBs could use this as an additional method at a local level, but it could not be used at a national level due to the large variations in surgery undertaken from one DHB to the next.

3.8.3  Background and rationale

The rate of incidence of infection is the number of new infections that occur in a defined population during the given time period. This is more accurately described as a risk but it is usually reported as a rate. The measure is reported as the number of SSI per 100 operations.

\[
\text{Incidence rate} = \frac{\text{number of patients who have a SSI in a specific period}}{\text{number of patients undergoing the operation/ procedure during the specific time period}} \times 100
\]

This is the standard format for reporting incidence rates for SSI – it is used by all SSI surveillance systems. It will allow comparison with between local, regional and national services with similar case mix and with other countries with similar provision of healthcare.
3.9 Reporting

3.9.1 Recommendations

That participating hospitals be required to regularly submit data to the central data facility within specified time frames.

That data analysis is undertaken centrally in a timely manner.

That the use of confidence intervals (CI) be used for reporting rates and identifying problem areas and that the Standardised Infection Ratio (SIR) be considered for future use in intra-hospital comparisons over time, and inter-hospital comparisons.

That an annual report of findings at the DHB level is produced centrally for all participants and is publically available.

That data be made available to the DHB for local analysis at hospital and operator level.

3.9.2 Consultation feedback

The majority of submitters supported the use of confidence intervals and thought they were useful for interpreting statistics. It was noted that they could be difficult to interpret and understand; therefore the project team agreed it was essential that they be covered as part of the wider education package (see section 3.11.1).

The majority of submitters supported the public reporting of DHB and national SSI rates although many were concerned about the potential for media to misrepresent the data. A number highlighted the need to carefully interpret and explain the results. It was agreed that there is a need for clarity around the implications for DHBs who report higher than desired SSI rates, with one submitter expressing concern about this point by stating that 'shame and name is a poor method to encourage improved performance and must be strongly discouraged'.

3.9.3 Background and rationale

The goal of SSI surveillance should be the linking of outcomes (SSI rates) with the process (the surgical procedure including preoperative assessment and postoperative management). Prompt feedback of appropriate data to surgeons has been shown to be an important component of strategies to reduce SSI risk. Reporting must be done in such a manner as to allow adjustment for case mix.

Data submission should be conducted in a form that allows data to be managed and analysed both locally and nationally. This would allow annual centralised reporting of DHB rates and local analysis by each organisation as they see fit.

Rates should be stratified and reported nationally by risk once locally appropriate risk factors have been determined (see sections 3.7 and 3.8 for more information on risk stratification and calculations). DHBs will have their individual SSI rates calculated.
There are a number of equally valid methods for reporting rates but, in line with the rest of the programme, the VICNISS approach using confidence intervals (CI) to identify areas of concern has been adopted. These are equivalent to control limits. Rates exceeding the 95 percent CI are considered to be of concern and those exceeding the 99 percent CI require action.

The Standardised Infection Ratio (SIR) is a newer approach to reporting risk-adjusted rates and may be a better statistical method for public reporting of risk-adjusted infection rates. It is the most practical statistic for benchmark comparisons, intra-hospital comparisons over time and inter-hospital comparisons. It gives a better estimate of the true infection rate when small numerators or denominators are present in some or all of the four risk categories (0 – 3) and it gives greater precision as the confidence intervals are narrower.

For intra-hospital comparisons over time the monthly or surveillance period denominator may be small and hence statistically ‘unstable’. The SIR provides the best means of comparison in this situation. For inter-hospital comparisons the distribution of patient risk differs widely between hospitals. To minimise the bias associated with comparison between two hospitals with different distribution of risk, each hospital can be compared with the combined number of procedures for all the comparator hospitals. (Gaynes, 2000; Gaynes, 2001; Gustafson, 2006). The level at which the SIR value causes concern and requires action is not clearly defined.

Initially CIs will be used for reporting with the SIR reported as an additional statistic. This will help increase familiarity with the new method of reporting and will allow assessment of the appropriate cut-off values for action to be taken.

The annual report should not only document SSI rates but should also include descriptive data on rates of compliance with practices designed to reduce the risk of SSI. For example, rates of compliance with best antibiotic prophylaxis practice (including the choice, timing and dosing of prophylactic antibiotic agent). The report should also specify the number of DHB’s contributing data and the size (number of beds) of contributing hospitals. The SSI rate (ratio) is the mean or 50th percentile for the aggregated data.

In general, DHB specific rates should be reported to the DHB’s Quality Team for distribution to the Clinical Service undertaking the procedure/s and to the Senior Management Team. Some DHBs may choose to include the data in a Quality Reporting Framework.

Where the SSI rate for a procedure from an individual DHB exceeds the agreed acceptable rate then additional analysis of the data should be undertaken. Similarly if the report reveals that compliance with measures used to reduce the risk of SSI are suboptimal (eg, low rates of appropriately timed antibiotic administration) then further investigations or interventions should be implemented to improve adherence.

For DHBs with SSI rates that are high compared to national benchmarks (see previous page), a comprehensive audit would ideally be undertaken to assess adherence to a range of best practices aimed at reducing SSI. Single interventions that have been shown to improve outcomes have been placed together as a ‘bundle’ of interventions that when implemented may result in a reduction in SSI rates. Auditing of adherence to the components of the bundle may identify areas that should be targeted by quality improvement initiatives.

8 Examples of further means of analysis include chart reviews, case control studies and root cause analysis.
Decisions around the means of data collection, analysis and the reporting format should take into consideration the recent advances in information technology. While maintaining data security, integrity, and confidentiality, the system should have the capacity for each DHB to collect the data and for outcomes to be reported locally and nationally in a timely manner.

3.10 How to deliver a national SSI surveillance programme?

3.10.1 Recommendations

That the programme meets the current New Zealand Standard for infection prevention and control (Health and Disability Services Standard NZS 8134.3: 2008).

That the programme is centrally coordinated with ongoing national oversight, governance and leadership.

That a national advisory function be available to support the delivery of the programme.

3.10.2 Consultation feedback

The majority of submitters agreed that the surveillance programme should meet the current New Zealand Standard for infection prevention and control. The project team noted that the standard specifies the support structure for any infection prevention control programme including, for example, oversight of the programme and reporting requirements.

Almost all submitters agreed that the surveillance programme should be coordinated and governed centrally and all agreed there should be a national advisory function. One submitter noted that central coordination would ‘pool resources, optimise expertise, and reduce duplication’.

There was a call from a number of submitters for strong infection control representation. The project team agreed that any national function needed an appropriate skill mix, including both the ‘measuring’ and ‘doing’ of SSI surveillance (eg, infection control, epidemiology, surgical, consumer interests etc).

3.10.3 Background and rationale

The delivery of a national SSI surveillance programme will require strong leadership and support for the delivery systems and people who are going to undertake the data collection, analyse the data and report the results. This is essential to ensure that an effective surveillance programme is delivered.

The current New Zealand Standard for infection prevention and control (Health and Disability Services NZS 8134.3:2008) gives clear guidance on the governance of an infection control service within an organisation. A similar approach should be adopted for the governance structure for this programme. The key components of this Standard are:

- a clearly defined and documented programme
- the programme is developed in consultation with relevant key stakeholders
• a governing body demonstrates commitment to the programme and ensures that it is adequately resourced
• there is an annual review of the programme
• the responsibility for delivering the programme is clearly defined
• membership and size of the governance and advisory bodies are appropriate for the complexity of the programme and its role is clearly defined
• regular reporting processes and prompt notification of serious issues identified by the programme
• the staffing levels and responsibilities of support services are clearly identified and documented
• a clear process for early consultation and feedback to the participating DHB’s and key stakeholders when changes are proposed to the programme.

To support a nationally consistent approach to SSI surveillance, which is essential to allow meaningful comparisons between local incidence rates and national benchmarks, the following activities should be undertaken centrally:

• the overall implementation and maintenance of the programme
• analysis and reporting of data
• initiation of improvement activities
• communication of information to consumers and health care providers.

Accordingly the approach requires local education and culture change around SSI surveillance, supported by a nationally consistent approach to SSI surveillance.

The national advisory function needs to ensure that there is input from key stakeholders which, amongst other things, is used to inform the delivery of the programme nationally. Stakeholders may include, but are not limited to the following:

• Royal Australasian College of Surgeons
• DHB funding and planning
• Ministry of Health
• Quality Improvement Committee
• Consumer Representatives
• New Zealand Nursing Organisation (NZNO) National Division of Infection Control Nurses
• Australasian Society for Infectious Diseases (ASID)
• Infectious Diseases Physicians and Clinical Microbiologists
• Royal College of Pathologists of Australasia
• Public Health Specialists with experience in epidemiology
• Healthcare Epidemiologist
• ESR.

Successful overseas programmes have well established support structures as outlined in the following paragraphs.

3.10.3.1 NHSN – USA

The National Healthcare Safety Network (NHSN) is part of the Division of Healthcare Quality Promotion (DHQP) at CDC. The Division of Healthcare Quality Promotion (DHQP) is part of the National Center for Infectious Diseases, in CDC’s Coordinating Center for Infectious Diseases.
The Healthcare Outcomes Branch (HOB) conducts surveillance, research, and demonstration projects to measure the impact of healthcare-associated infections, adverse drug events, and other complications of healthcare. HOB staff work closely with healthcare practitioners and healthcare facilities and with partners in other federal agencies, accrediting bodies, and professional groups.

A major initiative currently underway in HOB is the National Healthcare Safety Network (NHSN), a web-based system for monitoring healthcare-associated adverse events. It is a voluntary, secure, internet-based surveillance system that integrates patient and healthcare personnel safety surveillance systems. A review of the programme in May 2008 stressed the need for visible recognition of NHSN to enable it to meet the challenge and remain the standard for HAI surveillance.

3.10.3.2 VICNISS – Australia

The VICNISS Coordinating Centre collects and analyses data from individual hospitals, and reports quarterly to participants and the Department of Human Services on aggregate, risk adjusted, procedure-specific infection rates. This information contributes to the development of accurate and reliable benchmarks against which hospitals and health services can assess their performance.

The VICNISS programme is overseen by an Advisory Committee. The Centre is staffed by a multidisciplinary team comprising infection control nurses, epidemiologists, infectious diseases physicians, an information technology officer and an education officer.

3.10.3.3 SSISS (HPA) – England

The Surgical Site Infection Surveillance Service (SSISS) is located within the Healthcare Associated Infection and Antimicrobial Resistance Department of the Health Protection Agency. The objectives of the SSISS are to provide national data on the incidence of SSI in specified groups of surgical procedures to support methods of surveillance and data validation that ensure high quality data suitable for comparison within and between hospital and to maintain, as far as possible, comparability with data previously collected so that trends over time can be evaluated.

The activities of this programme are overseen by the Advisory Committee on Antimicrobial Resistance and Healthcare Acquired Infections, a non statutory advisory non-Departmental public body.
3.11 Sustainability

3.11.1 Recommendations

Centralised delivery of the SSI surveillance programme

- That there is national commitment to ongoing training, education and research into SSI in New Zealand.
- That central advisory support is provided for staff within DHBs undertaking the surveillance activities, analysing data and reporting results.
- That a multifaceted approach is established to improve communication about SSI both to the health sector and the public.

SSI surveillance programme delivery

- That clear messages are published about the programme and its objectives so DHBs and other stakeholders understand why the surveillance activity is essential.
- That sustainable local and national structures and funding arrangements are established to successfully run the SSI surveillance programme over the long-term.
- That information technology solutions be developed and used to reduce the labour-intensive aspects of surveillance.

3.11.2 Consultation feedback

There was overwhelming support for the proposed approach to ensuring the sustainability of a national SSI programme. The main concern raised was around ensuring adequate resourcing of the programme. This concern would need to be addressed in the implementation phase.

3.11.3 Background and rationale

For a surveillance programme to deliver on its objective to reduce SSI, it must be able to document the impact of SSI (cost to organisations and individuals), monitor trends and evaluate the effectiveness of its activities. To do this successfully it needs to measure events and outcomes in healthcare; activities that can only be carried out by trained and skilled staff who are well resourced. Embedding surveillance in DHB Quality Programmes should contribute to long term sustainability.

A recent review of the NHSN programme at CDC highlighted the following issues as being key for the delivery and the expansion of the service:

- CDC needs to recognise NHSN as a high priority core surveillance activity and assure adequate support for the programme
NHSN should be seen as the expert entity for setting standards for surveillance of HAI and should be utilised throughout the healthcare delivery system. To do this will require embracing innovative technology.

- short-term and long-term strategic planning is required for expansion of the programme
- attention must be paid to lessening the burden of surveillance and developing user-friendly data collection
- collaboration with other services within the health sector should be encouraged
- continual expansion of metrics on processes of care that support prevention of HAI
- increase the visibility and awareness of the value of NHSN and channel findings from surveillance to groups such as consumers using media that will reach a wider audience. (DHQP, CDC, 2008).

A number of these issues are crucial for the sustainability of such a programme in New Zealand; well resourced with sustainable structures and funding arrangements, use of innovative technology, collective DHB ownership, strong linkage with key stakeholders and high visibility within the health sector and the wider public.
4 Conclusion

Systematic surveillance combined with timely reporting of infection rates to surgeons has been associated with reductions in the incidence of SSI. Based on these findings, many countries have implemented SSI surveillance programmes at a national level.

National surveillance programmes aim to identify and define cases of SSI using consistent definitions and case finding methods between hospitals. Such programmes allow hospitals to make meaningful comparisons between local incidence rates and national benchmarks. These comparisons should direct and motivate hospitals to reduce rates of SSI by making changes to surgical care practices. Indeed, there is little point in hospitals participating in a national surveillance programme if processes are not reviewed and changes made to practice based on the results obtained.

There are a number of potential ‘best practice’ approaches that can be targeted as part of an overall strategy to reduce SSI rates. These include, but are not limited to the following:

- appropriate choice of antibiotic prophylaxis
- appropriate weight-based dosing of antibiotic prophylaxis
- redosing of antibiotic prophylaxis after four hours for prolonged procedures
- administration of antibiotic prophylaxis within one hour prior to incision
- hair removal by clippers rather than shaving prior to surgery
- surgical field skin antisepsis with chlorhexidine
- maintenance of perioperative normothermia for colon surgery
- maintenance of perioperative glucose control prior to cardiac surgery.

Incidence rates of SSI can be reduced by implementing ‘bundles’ of surgical care best practices. For example, the Surgical Care Improvement Project (SCIP) bundle includes:

- appropriate timing and choice of antibiotic prophylaxis
- appropriate preoperative hair removal
- perioperative glucose control for cardiac surgery
- maintenance of perioperative normothermia for colon surgery.

An ideal SSI surveillance programme will not only prospectively measure SSI rates but will also prospectively record compliance with practices recognised to help prevent SSI such as those listed above. Reports can then not only document SSI rates, but also include specific, tailored recommendations to individual hospitals on aspects of surgical practice or ‘bundles’ that should be targeted for improvement.

Participation in a national surveillance system requires systematic prospective data collection by appropriately trained ICPs. The ICPs should work closely with hospital IT staff to minimise the burden of data collection. Data should then be submitted centrally for statistical analysis, calculation of SSI rates and reporting to individual DHBs on an annual basis.
## Appendix 1: Abbreviations and definitions

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHS</td>
<td>Australian Council on Healthcare Standards</td>
</tr>
<tr>
<td>ADHB</td>
<td>Auckland District Health Board</td>
</tr>
<tr>
<td>APIC</td>
<td>Association for Professionals in Infection Control and Epidemiology Inc</td>
</tr>
<tr>
<td>CABG</td>
<td>Coronary artery bypass graft</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>DAAs</td>
<td>Designated Audit Agencies</td>
</tr>
<tr>
<td>DHB</td>
<td>District Health Board</td>
</tr>
<tr>
<td>DIP</td>
<td>Deep incisional primary SSI</td>
</tr>
<tr>
<td>DIS</td>
<td>Deep incisional secondary SSI</td>
</tr>
<tr>
<td>ESR</td>
<td>Institute of Environmental Science and Research</td>
</tr>
<tr>
<td>HAI</td>
<td>Healthcare Acquired Infection</td>
</tr>
<tr>
<td>HOB</td>
<td>Healthcare Outcomes Branch (Centers for Disease Control and Prevention)</td>
</tr>
<tr>
<td>HPA</td>
<td>Health Protection Agency (England)</td>
</tr>
<tr>
<td>ICP</td>
<td>Infection control professional</td>
</tr>
<tr>
<td>LCSC</td>
<td>Lower segment caesarean section</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service (England, Scotland and Wales)</td>
</tr>
<tr>
<td>NHSN</td>
<td>National Healthcare Safety Network (USA)</td>
</tr>
<tr>
<td>NINSS</td>
<td>Nosocomial Infection National Surveillance Service (England)</td>
</tr>
<tr>
<td>NNIS</td>
<td>National Nosocomial Infection Surveillance System (USA)</td>
</tr>
<tr>
<td>NSW Health</td>
<td>New South Wales Department of Health</td>
</tr>
<tr>
<td>NQIP</td>
<td>National Quality Improvement Programme</td>
</tr>
<tr>
<td>OAG</td>
<td>Office of the Auditor General</td>
</tr>
<tr>
<td>QIC</td>
<td>National Quality Improvement Committee</td>
</tr>
<tr>
<td>PDS</td>
<td>Post discharge surveillance</td>
</tr>
<tr>
<td>SCIP</td>
<td>Surgical Care Improvement Programme</td>
</tr>
<tr>
<td>SENIC</td>
<td>Study on the Efficacy of Nosocomial Infection Control</td>
</tr>
<tr>
<td>SHEA</td>
<td>Society for Healthcare Epidemiologists</td>
</tr>
<tr>
<td>SIR</td>
<td>Standardised infection ratio</td>
</tr>
<tr>
<td>SIP</td>
<td>Superficial incisional primary SSI</td>
</tr>
<tr>
<td>SIS</td>
<td>Superficial incisional secondary SSI</td>
</tr>
<tr>
<td>SPC</td>
<td>Statistical Process Control</td>
</tr>
<tr>
<td>SSI</td>
<td>Surgical and procedural site infection</td>
</tr>
<tr>
<td>SSI-IAB</td>
<td>SSI at the intraabdominal specific site</td>
</tr>
<tr>
<td>SSISS</td>
<td>Surgical Site Infection Surveillance Service (England)</td>
</tr>
<tr>
<td>the Ministry</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>VICNISS</td>
<td>Victorian Nosocomial Infection Surveillance System (now known as the Hospital Acquired Infection Surveillance System for hospitals in Victoria, Australia)</td>
</tr>
</tbody>
</table>
Definitions

Emergency procedures – a procedure that is performed acutely due to patient (or foetal) deterioration and was not planned more than 24 hours in advance. All other procedures are considered “non-emergency”.

In-hospital infections – when a patient is diagnosed with an SSI while an inpatient or when readmitted to hospital within the specified timeframe (30 days or one year).

Nosocomial Infection (or HAI) – a localised or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) not present at the time of admission to the healthcare facility. Nosocomial infections are also referred to as hospital or healthcare acquired or associated infections.

Surveillance – the continuous and systematic process of collection, analysis, interpretation and dissemination of descriptive information for monitoring health problems.

6 Appendix 2: Health and Disability Commissioners Submission

16 November 2009

Henry Dowler
Project Manager
NQIP Infection Prevention and Control Programme
Henry.dowler@hankstar.co.nz

Dear Mr Dowler

Re: Draft Recommendations for a National Surgical and Procedural Site Infection Surveillance Programme

Thank you for giving HDC the opportunity to comment on the draft recommendations for a National Surgical and Procedural Site Infection Surveillance Programme (the draft recommendations). I note that the goal of the Surgical Site Infection (SSI) surveillance project is to develop recommendations for a national SSI surveillance programme, which ultimately aims to identify and measure SSI events to help inform quality improvement initiatives.

I strongly support the SSI surveillance project and the proposed SSI programme, and agree that all surgery funded by DHBs, including surgical procedures carried out by many private hospitals, should be captured by the SSI programme. I support all the draft recommendations made in the consultation document, and congratulate you on producing such a clear and comprehensive consultation document. I have made a few specific comments in relation to some of the draft recommendations below.

4.1 Use of National Healthcare Safety Network definitions
I support the use of NHSN definitions for SSI surveillance in New Zealand. It seems sensible to use the NHSN definitions given that they are well accepted.

4.4 Surveillance Methods
I agree with the proposed surveillance methods and with the recommendation not to undertake post discharge surveillance at this stage. However, I suggest that the infections designed to be picked up by the SSI programme should be more clearly defined. As currently recommended, surveillance is designed to pick up “infections (deep or superficial) which occurs within 30 days of an operation when the patient is an inpatient or is readmitted to hospital”. I suggest that this section needs to be re-worded to clarify that only in-hospital infections are to be captured by the SSI programme.

4.9 Reporting
I strongly support the public reporting of DHB and national rates. I have called for public reporting of comparative healthcare quality data for many years. In my view, the public has a legitimate interest in knowing this information, and the data will help drive quality improvement within DHBs by highlighting the systems and processes of “well-performing” DHBs.
4.10 — Delivering a National SSI surveillance programme
I agree with a national advisory function supporting the programme, and strongly support seeking input from consumer representatives to inform the delivery of the programme.

Conclusion
In summary, I consider the draft recommendations excellent. I commend you on your efforts to improve the quality of New Zealand health care. I trust my comments are of assistance, and look forward on being updated on the progress of this important project.

Yours sincerely

[Signature]

Ron Paterson
Health and Disability Commissioner
7 Appendix 3: Summary of consultation feedback and project team response

Section 3.1 – Definitions of SSI

- Overwhelming support for using the NHSN definitions – is internationally recognised and allows comparison both locally and nationally.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
<th>Project Team response</th>
</tr>
</thead>
</table>
| Allowance for ‘diagnosis of SSI by surgeon or attending physician’ problematic | Diagnosis needs to be in ‘real time’ not retrospective  
Training and education is essential to reduce variability in diagnosis and promote consistency |
| Can GPs and midwives diagnose superficial SSI? | Diagnosis needs to be in ‘real time’ not retrospective  
Training and education is essential to reduce variability in diagnosis and promote consistency |
| The same definitions should be used in ACHS clinical indicator set which are referenced in the new NQIP4 standards used by Quality Health NZ for hospital accreditation purposes | Agree it would be useful if definitions are consistent. Outside of scope of programme as not all DHBs go for accreditation and this is only one set of standards that can be used. |
| Superficial wound infections unlikely to be admitted unless there was another underlying problem e.g. unstable diabetes. | Aware of this limitation but aim is to pick up more serious infections. A patient may be re-admitted with a superficial wound infection if they have other significant co-morbidities or if there is concern that the wound infection may be deep or it is found to be deep at re-exploration. |
| What is the role of ACC treatment injuries? | Not relevant to this programme. |
| Need to review if definition is appropriate for cardiac surgery at a later date as surgeons often use their own definitions for infection rates. | Before each stage is introduced need to undertake significant groundwork, including consultation with relevant stakeholders, training and education |

Section 3.2 – Procedures for surveillance

- All submitters supported a staged approach to the implementation of the programme.
- The majority of submitters (16/24) supported the surgical procedures recommended for each stage of the programme.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
<th>Project Team response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeframes for the staged approach would be helpful</td>
<td>Agree. Felt that 3-5 years for the full implementation of this programme was realistic and provided ample opportunity for review.</td>
</tr>
<tr>
<td>Correct operational processes and procedures should be in place from the onset.</td>
<td>Agree. IT and education packages could be piloted to ensure they meet user needs</td>
</tr>
<tr>
<td>A staged approach would enable processes to be modified and information technology to be refined which should then permit the relatively easy collection of data to minimise compliance costs</td>
<td>Agree.</td>
</tr>
<tr>
<td>Should be flexibility in the approach so that DHBs could target surgical procedures that reflect local risk.</td>
<td>As a minimum, it is important to have national consistency (so all DHBs undertake the same procedures for surveillance) – in addition to the minimum, each DHB can target procedures that reflect local risk if they so wish</td>
</tr>
<tr>
<td>Clarification is needed on whether contaminated procedures would be included.</td>
<td>Includes all ‘clean’ and ‘clean contaminated’ surgical procedures and not ‘contaminated’ or ‘dirty’ procedures. Wounds are classified into one of 4 categories; clean, clean contaminated, contaminated and dirty. Contaminated wounds have infection rates of about 20% and are defined as “acute, nonpurulent inflammation; major technique break or major spill from a hollow organ; penetrating injury &lt; 4 hours old, chronic open wounds to be grafted or covered” – it is not expected that any of the procedures would fit into this category. An emergency LSCS is called a clean contaminated wound.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>It might be more manageable to have one orthopaedic procedure with caesarean section in the first stage.</td>
<td>As caesareans are high volume and have an underappreciated number of complications, it would be easier to start with orthopaedics which are lower volume and information is already collected as part of the National Joint Register.</td>
</tr>
<tr>
<td>Concern about what procedures might be included in stage three.</td>
<td>Consultation would be undertaken around what procedures would be included in stage three. All procedures in ICD9 are clean/clean contaminated procedures.</td>
</tr>
<tr>
<td>Need clear definitions and applications of emergency and elective caesareans / have concerns about merging elective and emergency caesareans.</td>
<td>Elective and emergency caesareans would be clearly identified using ICD9 (see appendix X)</td>
</tr>
<tr>
<td>Concerns expressed about including joint revisions.</td>
<td>The majority of joint revisions are not undertaken for ongoing infection. Looking at primary hip joints procedures registered with the National Joint Register only 1178 revisions of 48,858 primary conventional hip joint replacements were undertaken – 2.4% of all procedures. The most common cause was dislocation, 38%, and deep infection accounted for 15% of all revisions – it ranked 3rd equal along with loosening of the femoral component behind dislocation, loosening of the acetabular component (20%)¹¹.</td>
</tr>
<tr>
<td>Use ICD-10-CM code.</td>
<td>An updated 2009 version of ICD-10-CM is now available for public viewing. However, the codes in ICD-10-CM are not currently valid for any purpose or use. There is now an anticipated implementation date for the ICD-10-CM of October 1, 2013. (<a href="http://www.cdc.gov/nchs/icd/icd10cm.htm">http://www.cdc.gov/nchs/icd/icd10cm.htm</a>). Keep ICD-9</td>
</tr>
</tbody>
</table>

Section 3.3 – Approach to surveillance

- Almost all submitters on this question agreed or partially agreed that surveillance be performed on a minimum of 100 procedures. A number were concerned that 100 might not be enough to allow for meaningful comparisons.
- Only 2 disagreed, both proposing a larger numbers. One noted that ‘given the relatively low numbers of procedures and the known low incidence of infection, recommend that all patients be included in the surveillance. There is an expectation that all surgeons will participate in audit activity with ongoing peer review. Regular review of SSI is an expected part of such audit activity and should be maintained for each surgical procedure. Given that this data should be collected for all patients in respect to surgical audit there would be no additional compliance cost in providing this information as part of the national surveillance programme. Collecting data on all patients will enable an improved statistical analysis particularly when the deep infection rate is known to be low’.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
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</tr>
</thead>
<tbody>
<tr>
<td>The procedures chosen are ‘clean’ and would have a wound infection rate of 2-4%. If assume a wound infection rate of 3%, need 1208 patients in each group to detect a 50% reduction in infection rate with an alpha of 0.95 and beta of 0.2. As there are 21 DHBs there will be ample patients.</td>
<td>Some might have an infection rate of 10% which might result in outliers. Advice will be sought from a statistician on the recommendations and feedback received from the consultation. They will be asked what data needs to be collected to allow comparison at DHB, hospital and surgical practitioner levels.</td>
</tr>
<tr>
<td>Size of DHB and number of procedures might cause difficulties. Would have significant resource implications for smaller DHBs.</td>
<td></td>
</tr>
<tr>
<td>Might not be enough to compare study periods or institutions.</td>
<td></td>
</tr>
<tr>
<td>CABG numbers would not be great enough and needs to be reconsidered.</td>
<td></td>
</tr>
<tr>
<td>Would be preferable to have continuous and prospective surveillance.</td>
<td></td>
</tr>
<tr>
<td>Not clear where number comes from – need sufficient numbers for benchmarking.</td>
<td></td>
</tr>
<tr>
<td>Don’t agree with intermittent surveillance for over 100 procedures - consecutive procedures may mean that a particular surgeon may not be audited to the same extent as another due to leave, cancellation of surgery etc for that surveillance period. Recommend surveillance be undertaken at least twice per year and if a number of operations are chosen then the sample should relate to the number of surgeons opposed to the service (eg, 20 cases per surgeon). 100 is very low and can lead to selection bias which gets greater the larger the centre. The alternative is to do a larger number where possible and rotate operations.</td>
<td></td>
</tr>
<tr>
<td>Clarity is required as to whether the 100 refers to the total number of procedures surveyed or 100 of each selected procedure.</td>
<td>Amend R5 to read – That, in line with VICNISS, surveillance be performed on a minimum of 100 of each of the selected procedures, as follows.......’</td>
</tr>
<tr>
<td>Also use sentinel/serious event process, particularly for early onset infection, as this may provide these DHBs with more meaningful information to feedback to services involved</td>
<td>This is outside of the surveillance system but would allow a root cause analysis to be undertaken and would allow infections outside of the ‘100’ to be picked up.</td>
</tr>
</tbody>
</table>
Section 3.4 – Surveillance methods

- Majority supported the proposed surveillance methods.
- Submitters were split as to whether post discharge surveillance should be delayed and re-evaluated at a later date or introduced in the first stage. Recognised that resourcing, logistics and mechanics of post discharge surveillance are an issue. Those who felt a delay was appropriate agreed that it was very difficult to undertake and is problematic and resource intensive. One submitter stated that ‘Post-discharge surveillance would add significant additional compliance costs but without substantial benefit. Those superficial postoperative infections which are recognized and treated in the community are likely to result in mild inconvenience and relatively low cost (reflecting an additional medical consultation and pharmaceutical costs). Patients with any more serious infection will represent or be referred back to the surgical service and thereby captured as an episode of a significant infection’.
- However, it was recognised that post discharge surveillance would help provide a more ‘complete’ picture of SSI

<table>
<thead>
<tr>
<th>Consultation feedback</th>
<th>Project Team response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarify that only in-hospital infections are included.</td>
<td>Insert definition of in-hospital in the appendix (inpatient or readmission)</td>
</tr>
<tr>
<td>Need system to capture readmissions as coding for readmissions not always good and</td>
<td>Agree</td>
</tr>
<tr>
<td>difficult if readmitted to another hospital.</td>
<td></td>
</tr>
<tr>
<td>Surveillance methods are consistent with those used internationally.</td>
<td>There are a number of ways this could be implemented and should illustrate this using some international examples, eg, UK, VICNISS.</td>
</tr>
<tr>
<td>Will miss patients who have SSI and receive IV antibiotics in ED or at home via</td>
<td>Very few would fit into this and not be readmitted.</td>
</tr>
<tr>
<td>District Nursing service but are not admitted.</td>
<td></td>
</tr>
<tr>
<td>Include organ/space within 30 days because these occur in operations other than those</td>
<td>Reword R6 as follows: ‘infection (deep, superficial or organ/space) which occurs within 30 days’</td>
</tr>
<tr>
<td>in which a prosthesis is inserted.</td>
<td></td>
</tr>
<tr>
<td>Need more information around data collection.</td>
<td>See section 3.6 – How to monitor for event.</td>
</tr>
<tr>
<td>Although some organ/space infections will not present within the one year surveillance</td>
<td>Agree - and probably not related to the surgery.</td>
</tr>
<tr>
<td>period these are likely to be relatively uncommon.</td>
<td></td>
</tr>
<tr>
<td>Would be a pity to stop collecting post discharge data by those who are already</td>
<td>Can continue to collect post discharge surveillance locally but this would not be</td>
</tr>
<tr>
<td>collecting it.</td>
<td>comparable between DHBs or nationally.</td>
</tr>
<tr>
<td>Could lead to underestimation of the rates and effect validity of the data.</td>
<td>Recognise will miss around 30% of SSI, most of which will be superficial. Appreciate all will be captured with will get the majority of significant SSI as these will be readmitted. Important to prioritise the outcomes.</td>
</tr>
<tr>
<td>No international gold standard on how to undertake PDS in manner that is sensitive/</td>
<td>Need to re-evaluated in one year and, if appropriate, develop post discharge surveillance methodology based on findings. Would need strict adherence to a set of definitions to avoid ending up with non-comparable data</td>
</tr>
<tr>
<td>specific enough and that doesn’t have significant resource requirements. Could</td>
<td></td>
</tr>
<tr>
<td>District Nurse and GPs be included in SSI capture as they see most patients with post discharge SSI?</td>
<td></td>
</tr>
</tbody>
</table>
Section 3.5 – What data should be collected?

- Submitters were broadly supportive of the data to be collected. One noted that the proposed data set is the minimum available, while another felt that only ASA and the length and type of surgery should be collected. The project team recognises that each procedure will have a set of risk factors – some will cover all procedures and some will be unique to a single procedure.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
<th>Project Team response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection needs to be complete, available electronically and collation automated if data tabulation, analysis and reporting is to be managed effectively.</td>
<td>Agree</td>
</tr>
<tr>
<td>Most of the data is already collected in some form.</td>
<td>Agree</td>
</tr>
<tr>
<td>Add blood transfusion</td>
<td>No – although transfusion-related immunomodulation (TRIM) which is associated with blood transfusions is associated with a higher risk of SSI (^{12}), identifying blood transfusions as a risk factor would not result in a change in practice (eg, reduced blood transfusions) and collecting this information will increase the burden of data collection for minimal benefit.</td>
</tr>
<tr>
<td>Smoking</td>
<td>Agree – insert ‘current smoker’</td>
</tr>
<tr>
<td>History of diabetes</td>
<td>Agree. Insert yes and no answer, and if yes – oral hyperglycaemics or insulin therapy</td>
</tr>
<tr>
<td>Perioperative glucose control</td>
<td>No – intervention, not risk factor</td>
</tr>
<tr>
<td>Wound class</td>
<td>No – operation defines wound class</td>
</tr>
</tbody>
</table>
| Consistent definition of elective vs emergency procedure   | Agree in kind – although differentiating between procedures in this way is really only relevant to LSCS. Propose to differentiate between “emergency” vs “non-emergency” procedures rather than “emergency” versus “elective”. For example - a simple definition of an emergency procedure would be a procedure that is:  
  - performed acutely due to patient (or foetal) deterioration  
  - was not planned more than 24 hours in advance   
   All other procedures could then be considered “non-emergency”.  
   Whatever definition is used to define an emergency procedure will be arbitrary to some extent and imperfect - but it needs to be simple and easy to apply. This should be considered further in the implementation stage. |

\(^{12}\) References:

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Recommendation Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of clavien classification system</td>
<td>No – this is used for any surgical complication and is not specific to infection. Already using infection classification system – superficial, deep etc.</td>
</tr>
<tr>
<td>ASA grade</td>
<td>In peri operative data set already – shift to preoperative</td>
</tr>
<tr>
<td>Patient temperature as in prevention bundle for colorectal patients</td>
<td>Consider as part of stage 3 as procedure specific</td>
</tr>
<tr>
<td>Type of hair removal</td>
<td>Checked with DHBs and found no variability so do not need to add.</td>
</tr>
<tr>
<td>Drains – in situ or not</td>
<td>Consider in future – not relevant for orthopaedics</td>
</tr>
<tr>
<td>Dressing</td>
<td>No – too much variability</td>
</tr>
<tr>
<td>Additional variables with respect to caesareans</td>
<td>Procedure specific – consider when considering data set for caesarean surveillance</td>
</tr>
<tr>
<td>Immunosuppressed</td>
<td>No - accept they are at greater risk but very small numbers</td>
</tr>
<tr>
<td>Previous document MDRO</td>
<td>No – wouldn’t result in any changes that could reduce SSI</td>
</tr>
<tr>
<td>Pre-existing skin condition</td>
<td>No – wouldn’t result in any changes that could reduce SSI</td>
</tr>
<tr>
<td>Date of death be separated from discharge date</td>
<td>Agree</td>
</tr>
<tr>
<td>Skin preps are either alcohol based or not</td>
<td>No – not a risk factor</td>
</tr>
<tr>
<td>Race (rather than ethnicity)</td>
<td>Use terminology from NHI for standardisation</td>
</tr>
<tr>
<td>Use of antibiotic loaded cement</td>
<td>Yes – is already collected as part of the National Joint Register (NJR). The NJR data forms ask whether cement was used and if so, was it an antibiotic impregnated brand. In the eight year report to December 1996, antibiotic impregnated cement had been used in approximately half of over 31,000 primary hip implants in which cement was used, and in 60% of 25,000 primary knee implants in which cement was used.</td>
</tr>
<tr>
<td>Attach list for operator grade</td>
<td>Agree</td>
</tr>
<tr>
<td>Time of antibiotic administration may be difficult to ascertain.</td>
<td>Anaesthetist writes this down and allows for calculations.</td>
</tr>
<tr>
<td>Add another field for second organism</td>
<td>Agree</td>
</tr>
<tr>
<td>Route of antibiotic administration</td>
<td>Doesn’t change</td>
</tr>
<tr>
<td>Which SSI criteria was met, in addition to SSI Y/N and type</td>
<td>Would not add value.</td>
</tr>
<tr>
<td>Identify where re-operation/revision was required due to infection</td>
<td>Can already be done</td>
</tr>
<tr>
<td>Only variables that should be collected are ASA and length and type of surgery</td>
<td>Need to know more information and it can be easily found.</td>
</tr>
<tr>
<td>Data linked to WHO safer surgery checklist.</td>
<td>Not relevant</td>
</tr>
<tr>
<td>Only if data adds value at local level</td>
<td>Agree – this is a minimum data set and is in keeping with other international systems.</td>
</tr>
<tr>
<td>Extra trips to theatre</td>
<td>No – not a risk factor.</td>
</tr>
</tbody>
</table>

- All institutions currently have systems operating to collect some or all of this data, mostly using a combination of electronic and manual methods.
- Submitters proposed a range of ways to make data collection more efficient and effective, which fit under two key headings – electronic data collection and human resource/training/education. Project team took note of suggestions.
Section 3.6 – ‘How’ to monitor for event?

- Submitters were broadly supportive of the proposed approach on ‘how’ to monitor for an SSI event.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
<th>Project Team response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently microbiology samples not taken for hip/knee joint replacements which will exclude a large number of patients.</td>
<td>Should follow best practice and do this.</td>
</tr>
<tr>
<td>Electronic systems required. Too labour intensive to collect manually. IS systems not equal in all DHBs.</td>
<td>Agree IT is essential to success. There are a number of approaches which could be taken and there is a need to pull information from a wide range of sources.</td>
</tr>
<tr>
<td>Strategies for informing and engaging clinicians at local and national level need to be addressed</td>
<td>Agree – part of wider education and sustainability.</td>
</tr>
<tr>
<td>Start with paper data capture and excel as if you wait for IT then you wait forever.</td>
<td>No – too resource intensive and would not get buy-in from the sector. Not necessary to focus on swab taking.</td>
</tr>
<tr>
<td>Training of personnel essential. National programme should develop on-line training module on SSI diagnosis and proper swab taking.</td>
<td>Agree training is essential and need to develop a national strategy.</td>
</tr>
<tr>
<td>Funding should be ring fenced.</td>
<td>Implementation issue.</td>
</tr>
<tr>
<td>Need to look at feasibility of data mining</td>
<td>Agree</td>
</tr>
</tbody>
</table>

- Submitters suggested a number of alternative approaches to SSI case finding:

<table>
<thead>
<tr>
<th>Consultation feedback</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Microbiology laboratory based surveillance. National patient management system. Electronic monitoring in theatre that will interface with all reporting requirements. Work with coders nationally to ensure any admission with post-surgical infection is coded appropriately.</td>
<td>Agree that there are three essential elements – flagging system for readmissions, a clinically led tagging system and micro flagging system. Need to work with coders to get post surgical infection data as this is more difficult compared to coding for procedures (appendix)</td>
</tr>
<tr>
<td>GP’s refer patients with hip/knee replacements to orthopaedic outpatients if they suspect an SSI – more consistent review of cases and efficient collection of accurate data.</td>
<td>Problematic – if SSI an issue will be readmitted to hospital and captured in proposed approach.</td>
</tr>
<tr>
<td>Influenced by quality of training.</td>
<td>Implementation issue</td>
</tr>
</tbody>
</table>
Section 3.7 – Risk stratification

- The majority of submitters were supportive of the proposal to undertake risk stratification. One felt it ensures valid comparison between DHBs.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Only if done centrally</td>
<td>Agree</td>
</tr>
<tr>
<td>Necessary if benchmarking is the goal</td>
<td>Benchmarking is a goal</td>
</tr>
<tr>
<td>Will identify potential institutional and individual population factors with chance of addressing/improving infection rates</td>
<td></td>
</tr>
<tr>
<td>ASA is versatile</td>
<td>Incorrect. This score is calculated by the anaesthetist and there may be inter-observer variability.</td>
</tr>
<tr>
<td>Need consistent ASA approach across all DHBs</td>
<td>Agree – need to have a standard scoring system and each DHB may elect to audit the results from time to time. This may already be done by Anaesthetic Services.</td>
</tr>
<tr>
<td>Could capture smoking and obesity.</td>
<td>Already done in data sheet (smoking, height, weight)</td>
</tr>
<tr>
<td>Might be better to include comorbidities on data sheet</td>
<td>ASA covers this and it would increase complexity.</td>
</tr>
<tr>
<td>In smaller districts like size comparisons might be more useful given lower number of operations</td>
<td>Time is important to obtain number.</td>
</tr>
<tr>
<td>Complicates the process unless it is automated</td>
<td>Will be automated and will be collecting information already.</td>
</tr>
<tr>
<td>Sample is not large enough</td>
<td>All patients undergoing the procedure are risk stratified; this allows comparison of rates between services.</td>
</tr>
<tr>
<td>Should not be making process over complicated or results too difficult to interpret</td>
<td>The intention is to keep it as simple as possible and is a way to explain some of the variations in results. Allows comparison based on case mix.</td>
</tr>
<tr>
<td>Question value given additional work required.</td>
<td></td>
</tr>
</tbody>
</table>

- There was a mixed response to the question of whether it is important to determine New Zealand specific risk factors. Half felt that it was important as evidenced by the following comment ‘every country has it’s own individual patient mix and it is important to determine which patient groups are more at risk’ while others felt that NZ risks were no different to other western countries.
- The project team considered all the responses and agreed that the information was being collected anyway and it can be assessed in the future as to whether this provides benefits or not.
Section 3.8 – Risk (rate) calculations

- The majority of submitters were supportive of the proposal to undertake risk (rate) calculations. Two submitters suggested another approach, namely to count days since the last SSI (total and for each operation). The project team agreed this could be used at a DHB level, but could not be used at a national level due to the large variations in surgery undertaken from one DHB to the next.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>100 in total may not cover all of the surgeons or provide enough data to make interpretative comment on each DHB</td>
<td>100 is used to report the rate/risk – there may be more operations. See section 3.3 approach to surveillance for more discussion on numbers.</td>
</tr>
<tr>
<td>Take out word ‘risk’ from SSI rate as misleading</td>
<td>Provides both rate and risk so need to leave this in place</td>
</tr>
<tr>
<td>Agree with crude rate of SSI per 100 operations. But use ‘in-patient’ rate or ‘operative episode’ rate rather than ‘in-hospital’ rate. Rate would be SSI per 1000 in-patient days (made up of both pre- and post-operative in-patient days)</td>
<td>Not appropriate to use for SSI.</td>
</tr>
</tbody>
</table>

Section 3.9 – Reporting

- Initially an open question was asked to identify what information should be in both a national and DHB surveillance report. There were very mixed responses of which all will be considered.
- The majority of submitters supported the use of confidence intervals and thought they were useful for interpreting statistics. It was noted that they could be difficult to interpret and understand; therefore the project team agreed it was essential that they were part of the wider education package.
- The majority of submitters supported the public reporting of DHB and national rates although many were concerned about media representation of the data. A number highlighted the need to carefully interpret and explain the results. A couple suggested that the results be anonymous. There is a need for clarity around the implications of those DHBs who report higher than desired rates although one submitter clearly noted that ‘Shame and name is a poor method to encourage improved performance and must be strongly discouraged’.
Section 3.10 – How to deliver a national SSI surveillance programme?

- The majority of submitters agreed that the surveillance programme should meet the current NZ Standard for infection prevention and control. In response to the two submitters who did not agree, the project team noted that the standard specifies the support structure for any infection prevention control programme, for example, the oversight for the programme, reporting etc.
- Almost all submitters agreed that the surveillance programme should be coordinated and governed centrally and all agreed there should be a national advisory function. One noted that central coordination would ‘pool resources, optimise expertise, and reduce duplication’.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Must have strong infection control representation</td>
<td>Should have an appropriate skill mix as about ‘measuring’ and ‘doing’, eg, infection control, epidemiologist, surgeon, consumer etc.</td>
</tr>
<tr>
<td>Must be appropriately resourced and not by DHBs</td>
<td>Agree needs to be appropriately resourced but ‘how’ is implementation issue</td>
</tr>
<tr>
<td>Needs timely feedback</td>
<td>Agree</td>
</tr>
<tr>
<td>Appropriate to coordinate centrally but governance and leadership best suited to clinical boards within the DHB</td>
<td>Disagree – this will create variability and mean it will not necessarily get the importance it deserves. Needs central governance and leadership as it is a national system.</td>
</tr>
<tr>
<td>Would only be possible if all DHBs had equivalent IT tools, systems and support</td>
<td>Implementation issue.</td>
</tr>
<tr>
<td>Purpose should be prevention not monitoring.</td>
<td>Has elements of both</td>
</tr>
<tr>
<td>Needs to be independent of MoH as they have regulatory function with respect to DHBs</td>
<td>Important consideration</td>
</tr>
</tbody>
</table>

Section 3.11 – Sustainability

- There was overwhelming support for the proposed approach to ensuring the sustainability of the national SSI programme.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
<th>Project Team response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major concern is adequate resourcing nationally and locally.</td>
<td>Agree – implementation issue.</td>
</tr>
</tbody>
</table>

- Submitters were asked what else may be essential for the sustainability of a national SSI programme and responses incorporated good staff and training and appropriate expertise, sharing of lessons learnt and successes, keeping it simple, good support for DHBs, buy-in from DHBs and staff, sufficient funding, technology, regular review of programme so issues can be identified and addressed.
Other:

Significant support received from submitters about the proposal for a national SSI surveillance programme.

<table>
<thead>
<tr>
<th>Consultation feedback</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Major concern is adequate resourcing nationally and locally.</td>
<td>Agree – implementation issue.</td>
</tr>
<tr>
<td>Infection control representation is essential at all stages of the decision making process.</td>
<td>Agree – but also need representation of other key stakeholders.</td>
</tr>
<tr>
<td>Useful to be able to benchmark with Australia</td>
<td>Proposal aligns with VICNISS approach</td>
</tr>
<tr>
<td>Have had a concern throughout this process, that although not intended, the end result will be a requirement to do SSI surveillance without any change to the current systems or resources currently provided. This will not achieve what should be the prime focus of this activity – the indication of what elements are creating SSI risk so we can prevent SSI from happening. The proposed approach is more about being able to report on SSI occurrence not SSI reduction.</td>
<td>Recommendations will provide information for DHBs to act on to reduce incidence of SSI.</td>
</tr>
<tr>
<td>Need to clearly outline how this will be used to improve patient outcomes</td>
<td>Agree</td>
</tr>
<tr>
<td>Surveillance must be focused on improvement and getting prevention strategies in place so NZ decreases SSI rates</td>
<td>Agree</td>
</tr>
<tr>
<td>Recommend discussions with orthopaedic colleagues about their national database</td>
<td>Was done as part of development of recommendations. Three orthopaedic representatives on the Technical Reference Group.</td>
</tr>
<tr>
<td>The data available as part of the national programme should have a local element, relevant to the small numbers in small DHBs. To enable data to be fed back to individual surgeons within each organisation</td>
<td>That is intended. Waiting for statistician feedback.</td>
</tr>
<tr>
<td>Need to clarify whether there will be acceptable/unacceptable limits that need to be conformed to and how DHBs will be alerted to this.</td>
<td>To be considered as part of the implementation.</td>
</tr>
<tr>
<td>What strategies have been considered to deal with the results of the surveillance programme should DHBs be found to have significant SSI rates or who do not choose to participate? The conclusion makes the assumption that hospitals will be directed and motivated to reduce rates of SSI and make changes to surgical care practices – should there be a strategy/contingency plan to provide advice and support for individual DHBs who may ultimately need to address individuals/groups with evidence that changes to surgical practice are required?</td>
<td></td>
</tr>
<tr>
<td>Need thorough review of each step to identify success/problems before moving onto next</td>
<td>Agree</td>
</tr>
<tr>
<td>Main concern is lack of explicit costing of the project. Overall proposal places surveillance on very high pedestal but cost effectiveness of surveillance only discussed briefly – this is essential for balancing the amount of resource given to monitoring as opposed to action. Challenge is to ensure local information produces local action. Significant issue around lack of consistency etc between IT systems nationwide.</td>
<td>Can only undertake cost benefit analysis at this stage – further costing can be undertaken once implementation plan developed.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Realistic assessment of resource implications at individual DHB level needs to be considered at planning stage.</td>
<td>Agree</td>
</tr>
<tr>
<td>Private hospitals should be included / what about private hospitals – approximately 50% of elective surgery is undertaken in private hospitals and it is important to monitor the infection rate in that environment. Reasonable that they enter the programme in its second year, once the processes of data collection have been implemented and evaluated.</td>
<td>Recommendations capture all surgery funded by DHBs regardless of which facility carries this out so will include private hospitals on this level.</td>
</tr>
<tr>
<td>An aspect that is alluded to once (page 32) is the requirement for “local education and culture change around SSI surveillance” – these are potentially costly and time consuming to achieve in terms of resources and personnel to assist with a consistent message being sent out. DHBs may expect data collection and outcomes of the programme to be achieved by existing ICT as an additional function and ‘business as usual’ approach – are there to be any recommendation included as to the expected time and personnel the project may require.</td>
<td>To be considered as part of implementation.</td>
</tr>
<tr>
<td>Paramount that IT are consulted and is set up well in advance of surveillance being introduced with support for staff using it.</td>
<td>Noted</td>
</tr>
<tr>
<td>Because of the criteria used to determine a SSI, some manual collection of case-finding data, is necessary until there is a full electronic medical record developed. Enable demographic and operation data to be collected electronically into the surveillance data base but please do not divert scarce resources to such things as data mining, when manual chart review is the norm for the foreseeable future in New Zealand. Concentrate on getting the project running and support ICP’s before IT.</td>
<td>Will be considered as part of implementation.</td>
</tr>
<tr>
<td>This project is a unique opportunity to research IC practices around SSI surveillance starting from scratch. Internationally there is a scarcity of information about the cost-effectiveness of surveillance methods to inform such strategies. A (time-efficient) method could be developed to gather data on the time &amp; resources used to undertake the prescribed SSI surveillance and describe each DHB’s data collection and SSI case ascertainment approaches. Analyse this information to quantify the time, cost and value of undertaking surveillance, to answer such questions as “How long does it take and what does it cost to do SSI surveillance by X means? What is the most cost-effective method?</td>
<td>Will be considered as part of implementation.</td>
</tr>
</tbody>
</table>
Appendix 4: Summary of approaches to SSI surveillance

Surveillance of HAI, including SSI, requires a continuous and systematic process for the collection, analysis, interpretation and dissemination of infection rates. This allows for long-term trends to be identified and baseline (endemic) rates of infection to be calculated.

Conventional HAI surveillance has relied on ward rounds, reviews of medical charts and paper based reports of microbiologic results. A number of countries have introduced national surveillance systems that consist of:

- local action to collect and report infection data
- local action to reduce infections
- national reporting of infection data
- nationally co-ordinated action to further reduce infections.

7.1 United States

The most established and respected surveillance system for healthcare-acquired infection is the National Nosocomial Infection Surveillance System (NNIS) developed by the Centres for Disease Control (CDC) in 1970. Around about 300 USA hospitals participate in this programme on a voluntary basis.

In 2005, CDC’s division of Healthcare Quality Promotion reviewed the NNIS and developed a new secure, internet-based surveillance system that integrates patient and healthcare personnel safety surveillance system. This new surveillance system is called the National Healthcare Safety Network (NHSN). It allows entry of event and denominator data for both device-associated and procedure-associated events as well as data entry for microbial susceptibility and antimicrobial use. (Horan, TC; Gaynes, RP; Martone, WJ; et al., 1992)

The NNIS/NHSN systems were designed to minimise the burden of data collection and reporting by participating hospitals. The reliability of the data depends on the assumption that the participating infection control professionals use standardised and validated NNIS/NHSN data collection protocols [standardised definitions of HAI and denominator data] and have no incentive to overestimate or underestimate their results.

NNIS/NHSN incorporates all of the requirements of an efficient surveillance system and has shown a return on the original investment. Reports from NNIS indicate that over the past decade, infection prevention programmes and surveillance systems have decreased the incidence of nosocomial bloodstream infections by between 31 and 44 percent. (National Surgical Quality Improvement Program)

The NHSN/NNIS surveillance methodology has successfully been adopted by other countries and within the Auckland District Health Board.
7.2 England

A national programme of SSI surveillance was established in England in 1997 as part of the Nosocomial Infection National Surveillance Service (NINSS). Participation in this programme was voluntary. The NINSS evolved into the Surgical Site Infection Surveillance Service (SSISS). Since 2004 reporting of SSI for England NHS Trusts has been mandatory in orthopaedics and voluntary surveillance in other categories of surgical procedures. (Health Protection Agency, 2004)

Active prospective surveillance is required over a minimum of three months on all patients undergoing surgery in a chosen category and standard surveillance methodology and NHSN case definitions are used.

Infection identification in England is laboratory-based for bloodstream infections and ward-based for SSIs and urinary tract infections. The main difference between this system and others is that it utilises a 24-hour post-hospitalisation determination for healthcare-associated infection rather than the standard 48 hours.

In 2008, a number of changes were made to the system, as follows:

- hip hemiarthroplasty category replaced by repair of neck of femur category
- new category for spinal strategy
- introduction of post discharge surveillance
- introduction of web based data entry and reporting.

7.3 Scotland

A national programme of SSI has been in place since 2002 – the Scottish Surveillance of Healthcare Associated Infection Programme (SSHAIP). This service supports mandatory reporting of SSI in orthopaedics and caesarean sections. Scottish NHS Trusts can also choose to submit data from at least 2 out of 10 procedures. (Health Protection Scotland, March 2007; Health Protection Scotland, 2007)

7.4 Australia

The New South Wales Department of Health (NSW Health) has introduced the Infection Control Programme Quality Monitoring system. In 1998, a surveillance project funded by NSW Health was piloted in 10 public hospitals using the NNIS definitions for the surveillance of hospital-acquired infections. NSW Health and the Australian Council on Healthcare Standards (ACHS) jointly developed a mandatory system and a methodology for collecting and reporting data. The pilot programme has since been mandated for over 200 hospitals throughout NSW. Reports are used to evaluate and improve infection control programmes, practices and policies. The data are collected every six months and the aggregated data are reported on the NSW Health website. (Gaynes, et al., 2001)

The Victorian Hospital-Acquired Infection Surveillance System (VICNISS), established in 2002, uses the NNIS definitions. This system has type 1 (larger hospital) and type 2 (smaller hospital) surveillance programmes.
The Western Australia Department of Health Healthcare Associated Infection Unit (HCAIU)) has been gathering data since 2005 and this has been mandatory for public hospitals since October 2007. This programme uses nationally endorsed standardised definitions of SSI. (Victorian Government, 2007)

In July 2008, the Australian Commission on Safety and Quality in Health Care released a report called ‘Reducing harm to patients from healthcare associated infection: the role of surveillance’. (Cruickshank and Ferguson, 2008) This report looked at surveillance as a whole and then within specific areas. It includes a review of current Australian SSI surveillance practice across all jurisdictions and concludes with a number of recommendations around the process.

### 7.5 New Zealand

In New Zealand there is currently no nationally co-ordinated SSI surveillance programme. The extent and range of SSI surveillance varies between DHB, as does the methodology and reporting format.

The option of a national surveillance programme in New Zealand has been considered by the Ministry since 1996. In the early 1990s, the ‘HAI surveillance system’ (HAISS) was proposed and in the late 1990s a national surveillance programme with the acronym ‘RISK’ (reducing infection through surveillance and knowledge) was proposed as a joint venture between Alexander and Alexander, the Institute of Environmental Science and Research (ESR) and Medlab South. However, both HAISS and RISK were deemed cost-prohibitive at the time.

In 2000, a New Zealand Standard (NZS 8142: 2000 Infection Control) was released to provide guidance on how to reduce the spread of infection within New Zealand healthcare facilities. The Health and Disability Services (Safety) Act 2001 requires Designated Audit Agencies (DAAs) to audit healthcare facilities in order to measure compliance against this Standard.

In June 2003, the Controller and Auditor-General published a report on the management of HAI in public hospitals in New Zealand to describe and assess systems for managing hospital-acquired infection in public hospitals. This report, Management of Hospital-Acquired Infection (Controller and Auditor General Office, 2003), comprehensively examined current infection control procedures in New Zealand public hospitals.

This report found that some dimensions of infection control, such as collaboration between infection control and laboratory staff, are working well. However, other areas, for example the auditing of infection control practices in hospitals, require attention. The report outlined 39 recommendations to improve infection control practices in New Zealand hospitals.

One of the recommendations was that the Ministry of Health, in consultation with DHB’s, should draw up guidance on how and to what extent surveillance data should be collected.

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13 Note that this has since been updated to NZS 8134:3:2008.
Infection control teams were to review how surveillance data was reported to quality managers and clinical teams.

In May 2004, the Health [Parliamentary Select] Committee requested a briefing from the Office of the Auditor General (OAG) and conducted an inquiry into the issue of hospital-acquired infections. The Health Committee supported the OAG review and subsequently presented the Report on Inquiry into Hospital-Acquired Infection to the House. This report recommended to the Government that the Ministry of Health work to implement three key recommendations to improve infection control practice across New Zealand. These were to:

1. establish a national surveillance system for infections acquired in the health and disability system

2. set and enforce nationwide standards that apply to the collection of data on hospital-acquired infection rates and hospital-acquired bloodstream infection rates

3. ensure comparative data on all bloodstream infections and hospital-acquired infections is posted on the Ministry of Health website and is updated regularly.


In response the Ministry formed an expert group of professionals from across the healthcare sector in order to assess and evaluate the efficacy of possible surveillance solutions. Suggested solutions were for the national surveillance of the complete health and disability system (at primary, secondary and tertiary levels). The following six options for national surveillance were considered:

1. maintain the status quo

2. add further indicators to the Hospital Benchmark Information

3. laboratory-based surveillance based around data currently collected by ESR and developing this further

4. monitor sentinel infections through further development of existing surveillance programmes. Such a programme could start with pilot sites and include, for example, intensive care unit infection surveillance for a defined period of time each year, ‘beef-up’ current bloodstream infection surveillance (e.g., adopt USA/Australian definitions, etc.), develop UTI surveillance in long-term care, and investigate current Royal Australasian College of Surgeons Orthopaedic Joint Surgery Database (would need definitions sorted out as well as investigating methodology etc) as a starting package

5. align with the Australian surveillance system implemented as mandatory in NSW

6. develop and implement a gold-standard national surveillance system for monitoring HAI throughout the health and disability system based on the best systems internationally.

In September 2004, the Ministry distributed an options paper to all DHBs. Two thirds of all submitters favoured option 5 – to implement the NSW system. A significant number of submitters additionally recommended the formation of a national infection control committee to oversee the development, implementation and reporting of data from a national surveillance programme and other infection control advisory activities.
The Ministry submitted a report to OAG during 2005. This SSI surveillance project is the first major piece of work in this area since this time.

Table two provides a summary of current New Zealand and international approaches to SSI surveillance.

**Abbreviations used in table two:**

- **ACHS**: Australian Council on Healthcare Standards
- **CABG**: Coronary Artery Bypass Graft
- **CDC**: Centers for Disease Control and Prevention
- **DHBs**: District Health Boards
- **HAI**: Healthcare Acquired Infections
- **LCSC**: Lower segment caesarean section
- **NHS**: National Health Service (England and Scotland)
- **NHSN**: National Healthcare Safety Network (USA)
- **NNIS**: National Nosocomial Infection Surveillance System (USA)
- **SPC**: Statistical Process Control
- **VICNISS**: Victorian Nosocomial Infection Surveillance System (now known as the Hospital Acquired Infection Surveillance System for hospitals in Victoria, Australia).

14 Previously NNIS
### Table two: Summary of New Zealand and international approaches to SSI surveillance

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of surveillance</th>
<th>Definitions used</th>
<th>Data collection process</th>
<th>How data submitted/ reported</th>
<th>Rates/Impact data</th>
<th>Other useful information, eg, post discharge surveillance, funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ15</td>
<td>Voluntary. In-house surveillance is carried out in most hospitals (19 out of 21 DHBs). NQIP</td>
<td>NHSN ACHCS</td>
<td>There is no standard method of data collection.</td>
<td>Usually to 'internal key personnel'.</td>
<td>No data published. Results in local action.</td>
<td>Various methods of post discharge surveillance are being used (ie, patient questionnaire, phone calls).</td>
</tr>
<tr>
<td>USA16 (NHSN)</td>
<td>In 2007 many states had mandatory reporting of HAI.</td>
<td>CDC NHSN</td>
<td>Paper based form. Variable for individual hospitals; electronic submission of data to NHSN</td>
<td>Web-based data entry Reported as risk-adjusted data that can be used for interfacility comparisons and local quality improvement activities</td>
<td>Data collected in NHSN are used for improving patient safety at the local and national levels. In aggregate, CDC analyzes and publishes surveillance data to estimate and characterize the national burden of healthcare-associated infections. There have been significant decreases in the rates of SSI since the introduction of NHSN.</td>
<td>NHSN does not include post discharge data. NHSN is used by hospitals to meet mandatory reporting requirements.</td>
</tr>
<tr>
<td>England (SSISS)17</td>
<td>Since 2004, mandatory orthopaedic hip and knee replacement, hip hemiarthroplasty, open reduction of long bone fracture for at least one three month period per year for all English NHS Trusts.</td>
<td>CDC NNIS Risk index</td>
<td>Paper based. Prospective and continuous.</td>
<td>At the end of each surveillance period, participating Trusts receive an individual report that contains their results compared to the data aggregated from all participating hospitals.</td>
<td>Rates of SSI have continued to decrease with a significant fall between the first (2004/05) and fourth year (2007/08) in each of the four orthopaedic categories.</td>
<td>Post discharge surveillance being developed.</td>
</tr>
<tr>
<td>Scotland (SSHAIP)18</td>
<td>Mandatory (partial) national standardised SSI in place since 2002. Scottish NHS Trusts choose to submit data from at least 2 out of 10 procedures, of which hip arthroplasty and c-section are mandatory, if performed.</td>
<td>CDC NNIS Risk index</td>
<td>Prospective and continuous. Local data is uploaded to SSHAIP data base (on-line web based).</td>
<td>Data submitted to a central body which compiles an annual report. SSI rates generally reported in form of SPC charts. Some of the key risk factor data is audited against best practice “SIGN” guidelines (ie, timing of antibiotic prophylaxis prior to surgery).</td>
<td>Downward trend in SSI rates demonstrated in all procedures over duration of surveillance. Of particular note, inguinal SSI rates for hip arthroplasty declined from 1.9% (2003) to 1.1% (2007), and knee arthroplasty declined from 0.9% (2003) to 0.3% (2007).</td>
<td>30 day post discharge surveillance for c-section. Readmission surveillance until day 30 for hip arthroplasties.</td>
</tr>
</tbody>
</table>

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17 [www.hpa.org.uk/web/HPAWebFile/HPAweb_C/1227774003450](http://www.hpa.org.uk/web/HPAWebFile/HPAweb_C/1227774003450)  
18 [www.hps.scot.nhs.uk/haic/sshaip/publications.aspx](http://www.hps.scot.nhs.uk/haic/sshaip/publications.aspx)
<table>
<thead>
<tr>
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<th>Definitions used</th>
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<th>Rates/Impact data</th>
<th>Other useful information, eg, post discharge surveillance, funding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Victoria (VICNISS)</strong>&lt;sup&gt;19&lt;/sup&gt;</td>
<td>Voluntary (98% participation of public hospitals in Victoria), CABG, colon surgery, c-section, hip and knee arthroplasties.</td>
<td>AICA, NNIS</td>
<td>Prospective surveillance to be undertaken on a minimum of 100 of each procedure per annum. Mainly paper based system. Due to resources some hospitals are only able to collect data retrospectively.</td>
<td>Centralised coordinating centre which analyses data from individual hospitals and reports quarterly to participants and department of Human Services.</td>
<td>The 2008 report shows a trend towards reduction in SSI rates following CABG, hip arthroplasty and caesarean sections. Currently no post discharge surveillance. Used by the Department of Human Services as a performance indicator. State-wide Quality Branch of the Department of Human Services provides support for VICNISS.</td>
</tr>
<tr>
<td><strong>NSW</strong>&lt;sup&gt;21&lt;/sup&gt;</td>
<td>Voluntary since 2003. Hip and knee replacement, CABG, elective colectomy, femoropopliteal bypass, open abdominal aortic aneurysm, LCSC and abdominal hysterectomy.</td>
<td>CDC NNIS Risk index</td>
<td>Prospective and continuous.</td>
<td>Data is collected in strict accordance with the definitions specified in the Users’ Manual. This ensures that data submitted to the ACHS are consistent. However Health Care Organisations are required to demonstrate their improvements and achievements through the use of data.</td>
<td>The rate of superficial incisional SSI in hip prosthesis procedures decreased, and the rate of deep incisional SSI in hip prosthesis procedures) increased. When the four years of data were combined the mean rates of superficial infections for the procedures ranged from 0.9% to 1.6% except for elective colectomy (3.3%) and femoral-popliteal bypass (4.8%). The mean rates for deep/organ space SSI ranged from 0.2% to 0.8% with the exception of elective colectomy (1.5%) and femoral-popliteal bypass (1.6%) Government funded. The service offers the potential of national and peer group benchmarking.</td>
</tr>
<tr>
<td><strong>Western Australia</strong>&lt;sup&gt;22&lt;/sup&gt;</td>
<td>Voluntary since 2005. Mandatory since 2007 for hip and knee arthroplasty.</td>
<td>CDC (NHSN)</td>
<td>Prospective and continuous.</td>
<td>Quarterly reports and annual on Healthcare Infection Surveillance Western Australia website</td>
<td>The overall SSI rate following hip arthroplasty was 1.19 per 100 procedures, and following knee arthroplasty was 1.38 per 100 procedures. Changes in SSI rates over the 3 years are not statistically significant. This report describes a 35% decrease in the hip SSI rate and a 7% decrease in the knee SSI rate from the last reporting period. Currently no post discharge surveillance.</td>
</tr>
</tbody>
</table>

<sup>19</sup> www.vicniss.org.au/
<table>
<thead>
<tr>
<th>Type of surveillance continued</th>
<th>Definitions used</th>
<th>Data collection process</th>
<th>How data submitted/ reported</th>
<th>Rates/Impact data</th>
<th>Other useful information, eg, post discharge surveillance, funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands (PREZIES) (1996)</td>
<td>Voluntary. A number of procedures are reported.</td>
<td>CDC with slight modification. NNIS risk index with some modification.</td>
<td>Prospective and continuous. Hospitals receive a procedure-specific feedback report every time they send in data.</td>
<td>Government funded. Risk of infection was reduced for patients who had an operation during the fourth surveillance and decreased further for patients operated on during the fifth as compared with patients who underwent surgery within one year of the start of surveillance in their hospital.</td>
<td>Post discharge surveillance is voluntary (70% perform PDS).</td>
</tr>
<tr>
<td>Germany (KISS) (1997)</td>
<td>Mandatory hip and knee joint replacement. Other procedures reported.</td>
<td>CDC NNIS Risk index</td>
<td>Prospective and continuous. Paper and computer based.</td>
<td>A comparison of data from the first and the third years show a significant SSI reduction with hip procedures, with a relative risk of 0.54 (CI95 0.38–0.77), and a trend towards reduced SSI rates for knee procedures.</td>
<td>Post discharge surveillance is encouraged. Government funded.</td>
</tr>
</tbody>
</table>

23 [http://www.journals.uchicago.edu/doi/abs/10.1086/501923](http://www.journals.uchicago.edu/doi/abs/10.1086/501923)

24 [http://www.sciencedirect.com/content/7p1131260112441v/](http://www.sciencedirect.com/content/7p1131260112441v/) and [https://openaccess.leidenuniv.nl/bitstream/1887/13143/11/05_2.pdf](https://openaccess.leidenuniv.nl/bitstream/1887/13143/11/05_2.pdf)
8 Appendix 5: NHSN definitions of SSI

There are three levels of SSI definitions under NHSN:

1. superficial incisional SSI
2. deep incisional SSI
3. organ/space SSI.

8.1 Definition of superficial incisional SSI

Superficial incisional SSI must meet the following criterion:

_Infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissue of the incision and patient has at least 1 of the following:_

a. _purulent drainage from the superficial incision_

b. _organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision_

c. _at least 1 of the following signs or symptoms of infection:_
   - pain or tenderness
   - localized swelling
   - redness
   - or heat

_and superficial incision is deliberately opened by surgeon and is culture positive or not cultured. A culture-negative finding does not meet this criterion._

d. _diagnosis of superficial incisional SSI by the surgeon or attending physician._

There are 2 specific types of superficial incisional SSI:

1. _superficial incisional primary (SIP): a superficial incisional SSI that is identified in the primary incision in a patient who has had an operation with 1 or more incisions (eg, C-section incision or chest incision for CBGB with a donor site)._ 

2. _superficial incisional secondary (SIS): a superficial incisional SSI that is identified in the secondary incision in a patient who has had an operation with more than 1 incision (eg, donor site [leg] incision for coronary artery bypass graft)._
8.2 Definition of deep incisional SSI

Deep incisional SSI must meet the following criterion:

Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure and involves deep soft tissues (eg, facial and muscle layers) of the incision and patient has at least 1 of the following:

a. purulent drainage from the deep incision but not from the organ/space component of the surgical site

b. a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured when the patient has at least 1 of the following signs or symptoms:

- fever (>38°C)
- or localized pain or tenderness

A culture-negative finding does not meet this criterion.

c. an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination

d. diagnosis of a deep incisional SSI by a surgeon or attending physician.

There are 2 specific types of deep incisional SSI:

1. deep incisional primary (DIP): a deep incisional SSI that is identified in a primary incision in a patient who has had an operation with one or more incisions (eg, C-section incision or chest incision for CABG).

2. deep incisional secondary (DIS): a deep incisional SSI that is identified in the secondary incision in a patient who has had an operation with more than 1 incision (eg, donor site [leg] incision for CABG).

8.3 Definition of organ/space SSI

An organ/space SSI involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure. Specific sites are assigned to organ/space SSI to identify further the location of the infection. An example is appendectomy with subsequent subdiaphragmatic abscess, which would be reported as an organ/space SSI at the intraabdominal specific site (SSI-IAB).

An organ/space SSI must meet the following criterion:

Infection occurs within 30 days after the operative procedure if no implant is left in place or within one year if implant is in place and the infection appears to be related to the operative procedure and infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure and patient has at least one of the following:
a. purulent drainage from a drain that is placed through a stab wound into the organ/space

b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space

c. an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination

d. diagnosis of an organ/space SSI by a surgeon or attending physician.

Occasionally an organ/space infection drains through the incision. Such infection generally does not involve reoperation and is considered a complication of the incision; therefore, classify it as a deep incisional SSI.
### Appendix 6: NHSN operative procedure categories

The following table outlines operative procedures and their grouping into NHSN operative procedure categories according to the *International Classification of Diseases, 9th Revision Clinical Modifications* (ICD-9-CM) codes. A brief description of the types of operations contained in the NHSN operative procedure categories is also provided. (Centers for Disease Control and Prevention, March 2009)

<table>
<thead>
<tr>
<th>NHSN Code</th>
<th>Operative Procedure</th>
<th>Description</th>
<th>ICD-9-CM Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>Abdominal aortic aneurysm repair</td>
<td>Resection of abdominal aorta with anastomosis or replacement</td>
<td>38.34, 38.44, 38.64</td>
</tr>
<tr>
<td>AMP</td>
<td>Limb amputation</td>
<td>Total or partial amputation or disarticulation of the upper or lower limbs, including digits</td>
<td>84.00-84.19, 84.91</td>
</tr>
<tr>
<td>APPY</td>
<td>Appendix surgery</td>
<td>Operation of appendix (not incidental to another procedure)</td>
<td>47.01, 47.09, 47.2, 47.91-47.92, 47.99</td>
</tr>
<tr>
<td>AVSD</td>
<td>Shunt for dialysis</td>
<td>Arteriovenostomy for renal dialysis</td>
<td>39.27</td>
</tr>
<tr>
<td>BILI</td>
<td>Bile duct, liver or pancreatic surgery</td>
<td>Excision of bile ducts or operative procedures on the biliary tract, liver or pancreas (does not include operations only on gallbladder)</td>
<td>50.0, 50.12, 50.14, 50.21-50.23, 50.25-50.26, 50.29-50.3, 50.4, 50.61, 50.69, 51.31-51.37, 51.39, 51.41-51.43, 51.49, 51.51, 51.59, 51.61-51.63, 51.69, 51.71-51.72, 51.79, 51.81-51.83, 51.89, 51.91-51.95, 51.99, 52.09, 52.12, 52.22, 52.3, 52.4, 52.51-52.53, 52.59-52.6, 52.7, 52.92, 52.95-52.96, 52.99</td>
</tr>
<tr>
<td>BRST</td>
<td>Breast surgery</td>
<td>Excision of lesion or tissue of breast including radical, modified, or quadrant resection, lumpectomy, incisional biopsy, or mammoplasty.</td>
<td>85.12, 85.20-85.23, 85.31-85.36, 85.41-85.48, 85.50, 85.53-85.54, 85.6, 85.70-85.76, 85.79, 85.93-85.96</td>
</tr>
<tr>
<td>CARD</td>
<td>Cardiac surgery</td>
<td>Open chest procedures on the valves or septum of heart, does not include coronary artery bypass graft, surgery on vessels, heart transplantation, or pacemaker implantation</td>
<td>35.00-35.04, 35.10-35.14, 35.20-35.28, 35.31-35.35, 35.39, 35.42, 35.50-35.51, 35.53-35.54, 35.60-35.63, 35.70-35.73, 35.81-35.84, 35.91-35.95, 35.98-35.99, 37.10-37.11, 37.24-37.25, 37.31-37.33, 37.35-37.36, 37.41, 37.49, 37.60*</td>
</tr>
<tr>
<td>CEA</td>
<td>Carotid endarterectomy</td>
<td>Carotid endarterectomy</td>
<td>38.12</td>
</tr>
<tr>
<td>CBGB</td>
<td>Coronary artery bypass graft with both chest and donor site incisions</td>
<td>Chest procedure to perform direct revascularization of the heart, includes obtaining suitable vein from donor site for grafting.</td>
<td>36.10-36.14, 36.19</td>
</tr>
<tr>
<td>CBGC</td>
<td>Coronary artery bypass graft with chest incision only</td>
<td>Chest procedure to perform direct vascularization of the heart using, for example the internal mammary (thoracic) artery</td>
<td>36.15-36.17, 36.2</td>
</tr>
<tr>
<td>CHOL</td>
<td>Gallbladder surgery</td>
<td>Cholecystectomy and cholecystotomy</td>
<td>51.03-51.04, 51.13, 51.21-51.24</td>
</tr>
<tr>
<td>COLO</td>
<td>Colon surgery</td>
<td>Incision, resection, or anastomosis of the large intestine; includes large-to-small and small-to-large bowel anastomosis; does not include rectal operations</td>
<td>17.31-17.36, 17.39, 45.03, 45.26, 45.41, 45.49, 45.52, 45.71-45.76, 45.79, 45.81-45.83, 45.92-45.95, 46.03-46.04, 46.10-46.11, 46.13-46.14, 46.43, 46.52, 46.75-46.76, 46.94</td>
</tr>
<tr>
<td>NHSN Code</td>
<td>Operative Procedure</td>
<td>Description</td>
<td>ICD-9-CM Codes</td>
</tr>
<tr>
<td>-----------</td>
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<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>CRAN</td>
<td>Craniotomy</td>
<td>Incision through the skull to excise, repair, or explore the brain; does not include taps or punctures</td>
<td>01.12-01.14, 01.21-01.25, 01.28, 01.31-01.32, 01.39, 01.41-01.42, 01.51-01.53, 01.59, 02.11-02.14, 02.91-02.93, 07.51-07.54, 07.59, 07.61-07.65, 07.68-07.69, 07.71-07.72, 07.79, 38.01, 38.11, 38.31, 38.41, 38.51, 38.61, 38.81, 39.28</td>
</tr>
<tr>
<td>CSEC</td>
<td>Cesarean section</td>
<td>Obstetrical delivery by Cesarean section</td>
<td>74.0, 74.1, 74.2, 74.4, 74.91, 74.99</td>
</tr>
<tr>
<td>FUSN</td>
<td>Spinal fusion</td>
<td>Immobilization of spinal column</td>
<td>81.00-81.08, 81.62-81.64, 84.51</td>
</tr>
<tr>
<td>FX</td>
<td>Open reduction of fracture</td>
<td>Open reduction of fracture or dislocation of long bones that requires internal or external fixation; does not include placement of joint prosthesis</td>
<td>79.21-79.22, 79.25-79.26, 79.31-79.32, 79.35-79.36, 79.51-79.52, 79.55-79.56</td>
</tr>
<tr>
<td>GAST</td>
<td>Gastric surgery</td>
<td>Incision or excision of stomach; includes subtotal or total gastrectomy; does not include vagotomy and fundoplication</td>
<td>43.0, 43.42, 43.49-43.5, 43.6, 43.7, 43.81, 43.89, 43.99, 44.15, 44.21, 44.29, 44.31, 44.38-44.42, 44.49-44.5, 44.61-44.65, 44.68-44.69, 44.95-44.98</td>
</tr>
<tr>
<td>HER</td>
<td>Herniorrhaphy</td>
<td>Repair of inguinal, femoral, umbilical, or anterior abdominal wall hernia; does not include repair of diaphragmatic or hiatal hernia or hernias at other body sites.</td>
<td>17.11-17.13, 17.21-17.24, 53.00-53.05, 53.10-53.17, 53.21, 53.29, 53.31, 53.39, 53.41-53.43, 53.49, 53.51, 53.59, 53.61-53.63, 53.69</td>
</tr>
<tr>
<td>HPRO</td>
<td>Hip prosthesis</td>
<td>Arthroplasty of hip</td>
<td>00.70-00.73, 00.85-00.87, 81.51-81.53</td>
</tr>
<tr>
<td>HTP</td>
<td>Heart transplant</td>
<td>Transplantation of heart; in/explantation of artificial heart</td>
<td>37.51-37.55</td>
</tr>
<tr>
<td>HYST</td>
<td>Abdominal hysterectomy</td>
<td>Removal of uterus through an abdominal incision</td>
<td>68.31, 68.39, 68.41, 68.49, 68.61, 68.69</td>
</tr>
<tr>
<td>KPRO</td>
<td>Knee prosthesis</td>
<td>Arthroplasty of knee</td>
<td>00.80-00.84, 81.54-81.55</td>
</tr>
<tr>
<td>KTP</td>
<td>Kidney transplant</td>
<td>Transplantation of kidney</td>
<td>55.61, 55.69</td>
</tr>
<tr>
<td>LAM</td>
<td>Laminectomy</td>
<td>Exploration or decompression of spinal cord through excision or incision into vertebral structures</td>
<td>03.01-03.02, 03.09, 80.50-80.51, 80.53-80.54+, 80.59, 84.60-84.69, 84.80 – 84.85</td>
</tr>
<tr>
<td>LTP</td>
<td>Liver transplant</td>
<td>Transplantation of liver</td>
<td>50.51, 50.59</td>
</tr>
<tr>
<td>NECK</td>
<td>Neck surgery</td>
<td>Major excision or incision of the larynx and radical neck dissection; does not include thyroid and parathyroid operations.</td>
<td>30.1, 30.21-30.22, 30.29-30.3, 30.4, 31.45, 40.40-40.42</td>
</tr>
<tr>
<td>NEPH</td>
<td>Kidney surgery</td>
<td>Resection or manipulation of the kidney with or without removal of related structures</td>
<td>55.01-55.02, 55.11-55.12, 55.24, 55.31-55.32, 55.34-55.35, 55.39-55.4, 55.51-55.52, 55.54, 55.91</td>
</tr>
<tr>
<td>PACE</td>
<td>Pacemaker surgery</td>
<td>Insertion, manipulation or replacement of pacemaker</td>
<td>00.50-00.54, 37.70-37.77, 37.79-37.83, 37.85-37.87, 37.89, 37.94-37.99</td>
</tr>
<tr>
<td>NHSN Code</td>
<td>Operative Procedure</td>
<td>Description</td>
<td>ICD-9-CM Codes</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PRST</td>
<td>Prostate surgery</td>
<td>Suprapubic, retropubic, radical, or perineal excision of the prostate; does not include transurethral resection of the prostate.</td>
<td>60.12, 60.3, 60.4, 60.5, 60.61-60.62, 60.69</td>
</tr>
<tr>
<td>PVBY</td>
<td>Peripheral vascular bypass surgery</td>
<td>Bypass operations on peripheral vessels</td>
<td>39.29</td>
</tr>
<tr>
<td>RFUSN</td>
<td>Refusion of spine</td>
<td>Refusion of spine</td>
<td>81.30-81.39</td>
</tr>
<tr>
<td>SB</td>
<td>Small bowel surgery</td>
<td>Incision or resection of the small intestine; does not include small-to-large bowel anastomosis</td>
<td>45.01-45.02, 45.15, 45.31-45.34, 45.51-45.63, 46.01-46.02, 46.20-46.24, 46.31, 46.39, 46.41, 46.51</td>
</tr>
<tr>
<td>SPLE</td>
<td>Spleen surgery</td>
<td>Resection or manipulation of spleen</td>
<td>41.2, 41.33, 41.41-41.43, 41.5, 41.93, 41.95, 41.99</td>
</tr>
<tr>
<td>THOR</td>
<td>Thoracic surgery</td>
<td>Noncardiac, nonvascular thoracic surgery; includes pneumonectomy and diaphragmatic or hiatal hernia repair</td>
<td>32.09-32.1, 32.20, 32.21-32.23, 32.25-32.26, 32.29-32.30, 32.39, 32.4, 32.41, 32.49, 32.50, 32.59, 32.6, 32.9, 33.0, 33.1, 33.20, 33.28, 33.31-33.34, 33.39, 33.41-33.43, 33.48-33.49, 33.98-33.99, 34.01-34.03, 34.06, 34.1, 34.20, 34.26, 34.3, 34.4, 34.51-34.52, 34.59-34.64, 34.84, 34.89, 34.93, 34.99, 53.71-53.72, 53.75, 53.80-53.84</td>
</tr>
<tr>
<td>THYR</td>
<td>Thyroid and/or parathyroid surgery</td>
<td>Resection or manipulation of thyroid and/or parathyroid</td>
<td>06.02, 06.09, 06.12, 06.2, 06.31, 06.39-06.4, 06.50-06.52, 06.6, 06.7, 06.81, 06.89, 06.91-06.95, 06.98-06.99</td>
</tr>
<tr>
<td>VHYS</td>
<td>Vaginal hysterectomy</td>
<td>Removal of the uterus through vaginal or perineal incision</td>
<td>68.51, 68.59, 68.7-68.71, 68.79</td>
</tr>
<tr>
<td>VSHN</td>
<td>Ventricular shunt</td>
<td>Ventricular shunt operations, including revision and removal of shunt</td>
<td>02.2, 02.31-02.35, 02.39, 02.42-02.43, 54.95</td>
</tr>
<tr>
<td>XLAP</td>
<td>Abdominal surgery</td>
<td>Abdominal operations not involving the gastrointestinal tract or biliary system</td>
<td>53.7, 54.0, 54.11-54.12, 54.19, 54.4, 54.51, 54.59, 54.61-54.64, 54.71-54.75, 54.92-54.93</td>
</tr>
</tbody>
</table>

NOTE: If the incision is not entirely closed at procedure’s end (i.e., if wires or tubes extrude through the incision) then the procedure does not meet the criteria of an NHSN operative procedure.

An NHSN operative procedure is defined as a procedure:

1) that is performed on a patient who is an NHSN inpatient or an NHSN outpatient

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 approach, and closes the incision before the patient leaves the OR)

3) that is included in the above Table.
### 10 Appendix 7: Examples of SSI data collection sheets

**Surveillance Data Sheet**

**Hip & Knee Replacements**

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Use to match with data collection form or web entry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Form available from <a href="https://www.ssiweb.hpa.nhs.uk/ssiweb">https://www.ssiweb.hpa.nhs.uk/ssiweb</a></td>
</tr>
</tbody>
</table>

**Surveillance Data Sheet**

- **Surveillance year:**
- **Patient Name:**
- **Ward:**
- **Date of Admission:** __/__/____ (DD/MM/YYYY)
- **Date of Birth:** __/__/____ (DD/MM/YYYY)
- **Hospital No.:**
- **Date of Operation:** __/__/____ (DD/MM/YYYY)
- **Gender:** Male / Female
- **Weight:** (Optional) kgs
- **Height:** (Optional) cms

**Primary Indication for Surgery**
- Osteoarthritis
- Inflammatory joint disease
- Avascular necrosis
- Trauma/fracture
- Revision due to infection
- Revision for fracture
- Revision for other reason
- Revision – reason unknown
- Other
- Unknown

**Revision of hip replacement**
- Acetabulum
- Stem
- Both

**Category of surgical procedure**
- Hip replacement
- Hip hemiarthroplasty
- Knee replacement
- Type of partial knee
  - Unicondylar
  - Patellofemoral

**Description of surgical procedure(s)**

1. ____________________________
   - **OPCS Code:**

2. ____________________________
   - **OPCS Code:**

**Type of surgery**
- Elective
- Emergency

**Operation due to trauma**
- Yes
- No

**Antibiotic - loaded cement**
- Yes
- No
- Unknown

**Antimicrobial prophylaxis**
- Yes
- No
- Unknown

**ASA score**
- 1
- 2
- 3
- 4
- 5
- Unknown

**Wound class**
- Clean
- Contaminated
- Dirty
- Unknown

**Duration of operation**
- Time of incision
- Time of closure
- Minutes

**Grade of surgeon**
- Consultant
- Associate specialist
- Staff grade
- Specialist registrar
- Senior house officer
- Other
- Unknown

**Surgeon Code 1**
(Optional)

**Surgeon Code 2**
(Optional)
<table>
<thead>
<tr>
<th>Ward visits for case review:</th>
<th>Other criteria for infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Signs/Symptoms</td>
</tr>
</tbody>
</table>

**Reason surveillance discontinued**
- Discharged home/to another care facility
- Died
- Late re-operation (after 72 hours)
- Follow-up completed after end of surveillance period

**Date surveillance discontinued:**

___ / ___ / ___ (DD/MM/YYYY)

**Surgical site infection**
- Yes
- No

**Detection of SSI**
- During admission
- On re-admission
- Other, post-discharge

**Date of onset of SSI:**

___ / ___ / ___ (DD/MM/YYYY)

**Type of SSI**
- Superficial incisional
- Deep incisional
- Organ-space

**Specific sites for organ or space SSI**
- Bone (Osteomyelitis)
- Joint or bursa

**Criteria for SSI**

Record inside one or more boxes the diagnostic criteria that apply.
- Purulent drainage
- Aspirated fluid/swab of surgical site yields organisms, and pus cells are present
- Abscess or other evidence of infection found during a re-operation, or by radiology or histopathology examination
- Incision spontaneously dehisces or opened by a surgeon
- Fever (temperature 38°C or more)
- Localised pain or tenderness
- Localised swelling
- Heat
- Redness
- Clinician’s diagnosis

**Subsequent SSI from the same surgical procedure**

Has the patient had a previous SSI related to this surgical procedure?
- Yes
  
If yes, record the serial number of the previous form on this, and any subsequent form completed for this patient.

**Causative micro-organism(s)**

Organism 1: _______
Organism 2: _______
Organism 3: _______

V7
Surgical Site Infection (SSI)

**required for saving  **required for completion
Event ID:

*Patient ID: Social Security #:*

Secondary ID:

Patient Name, Last: First: Middle:

*Gender: F M *Date of Birth:

Ethnicity (Specify): Race (Specify):

*Event Type: SSI *Date of Event:

*Date of Procedure: *NHSN Procedure Code:

ICD-9-CM Procedure Code: *Outpatient: Yes No *MDRO Infection: Yes No

*Date Admitted to Facility: Location:

Event Details

*Specific Event:*

☐ Superficial Incisional Primary (SIP)

☐ Superficial Incisional Secondary (SIS)

☐ Organ/Space (specify site):

☐ Deep Incisional Primary (DIP)

☐ Deep Incisional Secondary (DIS)

*Specify Criteria Used (check all that apply):

**Signs & Symptoms**

☐ Purulent drainage or material

☐ Pain or tenderness

☐ Localized swelling

☐ Redness

☐ Heat

☐ Fever

☐ Incision deliberately opened by surgeon

☐ Wound spontaneously dehisces

☐ Abscess

☐ Hypothermia

☐ Apnea

☐ Bradycardia

☐ Lethargy

☐ Cough

☐ Nausea

☐ Vomiting

☐ Dysuria

☐ Other evidence of infection found on direct exam, during surgery, or by diagnostic tests

☐ Other signs & symptoms^*

**Laboratory**

☐ Positive culture

☐ Not cultured

☐ Positive blood culture

☐ Blood culture not done or no organisms detected in blood

☐ Positive Gram stain when culture is negative or not done

☐ Other positive laboratory tests^*

☐ Radiographic evidence of infection

**Clinical Diagnosis**

☐ Physician diagnosis of this event type

☐ Physician institutes appropriate antimicrobial therapy^*

*Detectected: ☐ A (During admission) ☐ P (Post-discharge surveillance) ☐ R (Readmission)

*Secondary bloodstream Infection: Yes No

**Died: Yes No SSi Contributed to Death: Yes No

Discharge Date:

*Pathogens Identified: Yes No *If Yes, specify on page 2

Assurance of Confidentiality: The information obtained in this surveillance system that would permit identification of an 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, 305 and 309(a) of the Public Health Service Act (42 USC 240, 241, and 242HES).

Public reporting burden of this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC, Reports Clearance Officer, 1600 Clifton Rd., MS D-74, Atlanta, GA 30333, ATTN: FPA (0920-0666).

CDC 51.120 (Phent) Rev. 1

69
## Surgical Site Infection (SSI)

### Gram-positive Organisms

- **Coagulase-negative staphylococci (specify):**
  - Enterococcus faecalis: AMP, DAPTO, LNZ, PEN, VANC (SIRN SIRN SIRN SIRN SIRN)
  - Enterococcus faecium: AMP, DAPTO, LNZ, PEN, QUIDAL, VANC (SIRN SIRN SIRN SIRN SIRN)

- **Staphylococcus aureus:** CFOX, CLIND, DAPTO, ERYTH, GENT, LNZ, OX, QUIDAL, RIF, TMZ, VANC (SIRN SIRN SIRN SIRN SIRN SIRN SIRN SIRN SIRN SIRN SIRN SIRN)

### Gram-negative Organisms

- **Acinetobacter spp. (specify):** AMK, AMP, APSUL, CEFEP, CEFTAZ, CIPRO, GENT, IMI, LEVO, MERO, PIPTAZ, TOBRA (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN SIRNSIRN SIRNSIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Escherichia coli:** AMK, CEFEP, CEFTAZ, CEFTRX, CIPRO, IMI, LEVO, MERO (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Enterobacter spp. (specify):** AMK, CEFEP, CEFTAZ, CEFTRX, CIPRO, IMI, LEVO, MERO (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Klebsiella oxytoca:** AMK, CEFEP, CEFTAZ, CEFTRX, CIPRO, IMI, LEVO, MERO (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Klebsiella pneumoniae:** AMK, CEFEP, CEFTAZ, CEFTRX, CIPRO, IMI, LEVO, MERO (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Serratia marcescens:** AMK, CEFEP, CEFTAZ, CEFTRX, CIPRO, IMI, LEVO, MERO (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Pseudomonas aeruginosa:** AMK, CEFEP, CEFTAZ, CIPRO, IMI, LEVO, MERO, PIP (SIRN SIRN SIRN SIRN SIRN SIRN SIRNSIRN SIRNSIRN SIRNSIRN)

- **Stenotrophomonas maltophilia:** TMZ, SIRN

### Other Organisms

<table>
<thead>
<tr>
<th>Organism 1 (specify)</th>
<th>Drug 1</th>
<th>Drug 2</th>
<th>Drug 3</th>
<th>Drug 4</th>
<th>Drug 5</th>
<th>Drug 6</th>
<th>Drug 7</th>
<th>Drug 8</th>
<th>Drug 9</th>
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<tr>
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<td>SIRN</td>
<td>SIRNSIRN</td>
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<td>SIRN</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Organism 2 (specify)</th>
<th>Drug 1</th>
<th>Drug 2</th>
<th>Drug 3</th>
<th>Drug 4</th>
<th>Drug 5</th>
<th>Drug 6</th>
<th>Drug 7</th>
<th>Drug 8</th>
<th>Drug 9</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>SIRN</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Organism 3 (specify)</th>
<th>Drug 1</th>
<th>Drug 2</th>
<th>Drug 3</th>
<th>Drug 4</th>
<th>Drug 5</th>
<th>Drug 6</th>
<th>Drug 7</th>
<th>Drug 8</th>
<th>Drug 9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SIRN</td>
<td>SIRN</td>
<td>SIRNSIRN</td>
<td>SIRN</td>
<td>SIRN</td>
<td>SIRN</td>
<td>SIRN</td>
<td>SIRN</td>
<td>SIRN</td>
</tr>
</tbody>
</table>

**Result Codes:**
- S = Susceptible
- I = Intermediate
- R = Resistant
- N = not tested

**Drugs:**
- AMP = ampicillin
- AMPSUL = ampicillin/sulbactam
- CEFEP = cefepime
- CEFOTX = ceftoxime
- CLIND = clindamycin
- ERYTH = erythromycin
- GENT = gentamicin
- IMI = imipenem
- LEVO = levofloxacin
- MERO = meropenem
- MERO = moxifloxacin
- OX = oxacillin
- PEN = penicillin G
- PIP = piperacillin
- QUIDAL = quinupristin/dalfopristin
- RIF = rifampin
- TMZ = trimethoprim/sulfamethoxazole
- TOBRA = tobramycin
- VANCO = vancomycin
### Surgical Site Infection (SSI)

**Custom Fields**

<table>
<thead>
<tr>
<th>Label</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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</tbody>
</table>

**Comments**

---

**CDC 57.120 (Rev.)** Rev. 1
### VICNISS RECOMMENDED FIELDS – Fax to VICNISS 03 9342 2633

**Hospital Code Number**

<table>
<thead>
<tr>
<th>MRN (UR No.)</th>
<th>Sex: □ M □ F □ DOB: / /</th>
</tr>
</thead>
</table>

**Date Admitted to Hospital:** / / **Date Discharged from Hospital:** / /

**Surgeon (coded):**

* VICNISS Procedure Group:*
  - AAA
  - CBGB
  - COLO
  - GAST
  - KPRO
  - VHYST
  - APPY
  - CBGC
  - CRAN
  - HERN
  - REC
  - VSHN
  - BRST
  - CEA
  - CSEC
  - HPRO
  - SB
  - CARD
  - CHOL
  - FPOP
  - HYST
  - THOR

**Procedure:**

1. HPRO/KPRO/BRST/HERN/CEA Procedures Only
   - Left □ Right □ Bilateral □
2. HPRO/KPRO Procedures Only
   - Partial □ Total □ Primary □ Revision □

**ICD10AM code/s:**

**Start Time:** / / **End Time:** / / **Duration of Procedure:** D/MM/YYYY

**ASA Score:** Not Available 1 2 3 4 5

**Implant:** Yes □ No □ **Wound Classification:** C CC CO D NA

**Laparoscopic Approach:** Yes □ No □ **Multiple Procedures:** Yes □ No □

**Trauma:** Yes □ No □ **Emergency:** Yes □ No □

**Antibiotic Prophylaxis**

* If 'No', was Prophylaxis known to have been withheld because:
  - Patient already on antibiotics that are sufficient for surgical prophylaxis; or
  - Patient having joint revision and antibiotics to be given after old prosthesis removed for culture

**Prophylactic Antibiotics:** Yes □ No □

**Time of Administration**

<table>
<thead>
<tr>
<th>Time Given</th>
<th>Please provide EXACT TIME GIVEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 1 h prior to Incision □</td>
<td>Y □ N □</td>
</tr>
<tr>
<td>On Induction □</td>
<td>After Incision □</td>
</tr>
<tr>
<td>More than 1 h prior to Incision □</td>
<td>Y □ N □</td>
</tr>
<tr>
<td>On Induction □</td>
<td>After Incision □</td>
</tr>
<tr>
<td>More than 1 h prior to Incision □</td>
<td>Y □ N □</td>
</tr>
<tr>
<td>On Induction □</td>
<td>After Incision □</td>
</tr>
</tbody>
</table>

**Antibiotic Continued > 24hrs**

Y □ N □

**Outcome**

| Infection Detected: □ Yes □ No □ | Infection Date: / / |

---

1. Use Conner's Aden Bypass & Veal Form 1.5
2. Complete HPRO/KPRO/BRST/HERN/CEA procedures only field. Also see footnote 4 and 5.
3. Complete VSHN & CBGC procedures. Also see footnote 4.
4. Complete HPRO/KPRO/BRST/HERN/CEA procedures, start & end times or duration of procedure should include both left & right procedures.
5. Complete orthopaedic fields. Also see footnote 4.

VICNISS Version 6.1 2020
FORM 1.2 SURGICAL SITE INFECTION (NUMERATOR)

Hospital Code Number:  

<table>
<thead>
<tr>
<th>Patient ID:</th>
<th>MRN (UR No.):</th>
<th>DOB:</th>
<th>Procedure Date:</th>
</tr>
</thead>
</table>

Infection Details and Outcome  

<table>
<thead>
<tr>
<th>Infection Details and Outcome</th>
<th>Infection Date:</th>
</tr>
</thead>
</table>

If ‘Yes’, Detected:  

- During admission
- Post-discharge surveillance
- HETH
- Readmission

Infection Type:  

- Superficial incisional
- Deep incisional
- Organ / Space

If ‘Yes’ for Deep or Organ Space infections, was there a Previous Superficial Infection:  

- Yes
- No

If Bilateral Procedure, what side of the body was the Location of Infection:  

- Left
- Right

If ‘Yes’ for Organ Space infection, what was the Organ Space Site: (please tick)  

- Arterial or venous infection
- Breast abscess or mastitis
- Disc space
- Endocarditis
- Endometritis
- Intra-abdominal, not specified elsewhere
- Intracranial, brain abscess or dura
- Joint or bursa
- GI tract
- Meningitis or ventriculitis
- Myocarditis or pericarditis
- Upper respiratory tract
- Osteomyelitis
- Spinal abscess without meningitis
- Vaginal cuff

Organism Isolated:  

- Yes
- No

Name of Primary Organism:  

Organism & Sensitivity Matrix:

<table>
<thead>
<tr>
<th>Organism &amp; Sensitivity Matrix</th>
<th>Vancomycin</th>
<th>Fusidic Acid</th>
<th>Penicillin</th>
<th>Ampicillin</th>
<th>Methicillin*</th>
<th>Rifampicin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram positives</td>
<td>S</td>
<td>R</td>
<td>I</td>
<td>U</td>
<td>S</td>
<td>R</td>
</tr>
<tr>
<td>Coagulase negative staph.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Enterococcus faecium</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Other organisms:

- * Methicillin may be reported as equivalent Oxacillin or Fluocillin.

Gram negatives:

<table>
<thead>
<tr>
<th>Gram negatives</th>
<th>S - Sensitive</th>
<th>R - Resistant</th>
<th>I - Intermediate</th>
<th>U - Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achromobacter spp.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
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<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>E. coli</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>K. oxytoca</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>K. pneumoniae</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>P. aeruginosa</td>
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<td>S. marcescens</td>
<td>☐</td>
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<td>☐</td>
</tr>
<tr>
<td>S. maltophilia</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Other organisms:
11 Appendix 8: Background information on SSI surveillance

11.1 New Zealand rates of SSI

There is limited data on the rates of SSI in patients in New Zealand hospitals. Point-prevalence surveys were conducted twice a year, in May and November, in Auckland District Health Board (ADHB) hospitals from 1996 - 1999. The cumulative incidence of HAI for all patients was 6.33 percent, with surgical wound infections occurring in 2.82 percent of patients.\(^4\) A study from Christchurch in the mid-1990’s looking at the incidence of infections following clean general surgery showed an overall wound infection rate of 12.6 percent (inpatient: 4.5 percent; outpatient: 8.1 percent).\(^5\) A further study from ADHB showed the rate of post-sternotomy mediastinitis to be 1.2 percent\(^6\), in keeping with rates elsewhere.\(^6\) The cost of a single episode of post-sternotomy mediastinitis is approximately $46,000.\(^7\)

11.2 Risk Factors Associated with SSI

Risk factors for the development of SSI include patient-specific as well as procedure-specific factors. A prolonged pre-operative stay increases the risk, the mechanism by how this increases the infection risk is not well defined but may relate to the change in endogenous microbial flora that occurs with hospitalisation, the increased likelihood of procedures that allow microorganisms access into the body or therapeutic interventions that alter the patient’s immune response. Procedure related risk factors include the method of hair removal [shaving, dipping or depilatory], length of operation and surgical technique. The risk of infection will be minimised by control of bleeding, gentle traction and handling of tissue, removal of necrotic tissue and eradication of dead space. Host factors associated with an increased risk of SSI in some but not all studies include advanced age, obesity, diabetes, nutritional status and malignancy. For some of these risk factors there is sound scientific evidence supporting interventions.

11.3 Prevention of SSI

The prevention of surgical site infections can be directed toward one of three strategies; reducing the amount and type of microbial contamination, improving wound condition at the end of the operation through better surgical technique, and improving the host’s defences. The clinical events leading up to the development of infection can occur preoperatively or intra-operatively. As a consequence these preventative measures should be applied before or during the operation. The preventative measures include:

- short pre-operative stay
- host factors; hyperglycaemic control, improve nutritional status, weight loss
- preoperative skin preparation; antimicrobial showering to reduce microbial burden, hair removal/clipping or using a depilatory product rather than shaving
- antibiotic prophylaxis, appropriate choice of antibiotic, appropriate timing
- intraoperative skin preparation – chlorhexidine rather than povidine iodine
- surgical scrub – length of time and use of chlorhexidine
- barrier defences – masks, gowns, surgical drapes
- reducing airborne contamination in the operating room – reducing movement of operating room staff, HEPA filtration, laminar flow ventilation systems
- operation technique.
12 Bibliography


Health Protection Scotland. (2007). *Surveillance of Surgical Site Infections for procedures carried out from 1/04/02 - 30/06/07*.


Mayhall, C. G. (1 April 2004). *Hospital Epidemiology and Infection Control* (3 ed.). Lippincott Williams & Wilkens.


