Cardiac surgery implementation manual

Pukapuka aratohu whakahaere poka manawa

For providers implementing and delivering a national Surgical Site Infection Improvement Programme in New Zealand

SSII Surgical Site Infection Improvement Programme

Health Quality & Safety Commission New Zealand
Kupu Taurangi Hauora o Aotearoa

PO Box 25496
Wellington 6146

ISBN 978-0-908345-81-6 (print)
ISBN 978-0-908345-82-3 (online)

This document is available to download from the Health Quality & Safety Commission website: www.hqsc.govt.nz

Acknowledgements | He mihi

This implementation manual builds on the hard work and recommendations provided by the National Quality Improvement Programme (NQIP) in 2010. Thank you to all the contributors and authors involved in developing the manual. It is a key document for the programme.

Some of the content in this document has been drawn from information, resources and advice made available by organisations with well-established surgical site infection improvement programmes. The Health Quality & Safety Commission's Surgical Site Infection Improvement Programme (SSIIP) team would like to acknowledge the following organisations as integral to the development of the manual:

- Health Protection Scotland
- US Centers for Disease Control and Prevention
- Welsh Healthcare Associated Infection Programme
- VICNISS Healthcare Associated Infection Surveillance System.

Finally, thank you to the members of the SSIIP steering committee and clinical reference group, and cardiac surgery expert faculty group for their ongoing expertise.

Contents | Rārangi take

1 Document purpose | Take o te pukapuka

This manual provides guidance for implementing and delivering the national cardiac surgery Surgical Site Infection Improvement Programme (SSIIP) in New Zealand. The programme will enable standardisation of data, which can be analysed and reported both locally and nationally.

The intended audiences are: infection prevention and control (IPC) specialists, clinical microbiologists and infectious disease physicians, quality teams, nurses, anaesthetists and surgeons, and all of those involved in the SSIIP at a local level. A multidisciplinary approach is essential so the programme has the appropriate expertise.

2 About the SSIIP | Mō te SSIIP

The SSIIP is one component of the Health Quality & Safety Commission's (the Commission's) IPC programme. The IPC programme aims to reduce healthcare associated infections, including surgical site infections (SSIs).

SSIs can cause emotional and financial stress, serious illness, longer hospital stays, long-term disability and loss of life. The consequences for patients, as well as health services, mean that the prevention of SSIs is extremely important.

To address this, in 2012 the Commission entered into a partnership with Auckland and Canterbury District Health Boards to deliver a national SSIIP for district health boards (DHBs).

Drawing upon the 2010 report to the Ministry of Health, *Recommendations for a National Surgical and Procedural Site Infection Surveillance Programme*,[1] the SSIIP, in collaboration with DHBs throughout the country, has refined these recommendations and implemented a consistent, evidence-based approach for collecting and reporting high-quality data on selected cardiac procedures.

Through its consultative process, the SSIIP promotes culture change and practice improvements that focus on the prevention of SSIs. This encourages performance improvement by highlighting practice that may require attention. The programme also provides intervention guidance on how to drive improvements that result in safer patient care.

The cardiac surgery workstream was established in 2014 and public reporting commenced in March 2017 for procedures performed from 1 July 2016 onwards.

Between February 2016 and June 2018, the Accident Compensation Corporation (ACC) supported the Commission's SSIIP to work to reduce the incidence and harm of healthcare associated infections. The funding was used to complete the programme in DHBs for hip and knee arthroplasty and cardiac surgeries.

In 2016, delivery of the programme transitioned to the Commission. The programme is supported by the national SSIIP team. Dr Arthur Morris is the current SSIIP clinical lead and Canterbury DHB continues to provide hosting and application support.

The overarching objective of the SSIIP is to improve the quality of patient safety and care. It will also give hospitals a robust reporting system of infection rates, which will be made available to clinicians. Such feedback has been shown to lead to improvements in performance (Haley et al 1985). National data will also mean consistent measurements and allow comparison between DHBs.

The SSIIP seeks to:

- deliver a consistent approach to the monitoring of SSIs through the implementation of evidence-based surveillance guidelines
- provide accurate outcome measurement and reporting for SSIs through the implementation of a national monitoring system

1 See: www.hqsc.govt.nz/assets/Infection-Prevention/Surgical-Site-Infection-Surveillance/Report-on-SSI-Surveillance-to-QIC-and-MoH-15-March-2010.pdf

- lead quality improvement activities through the use of high-quality data
- achieve a 25 percent reduction in SSI rates within five years through the implementation of best practice improvement interventions
- drive the required culture and behaviour changes through reporting back to local clinical teams.

3 Executive summary | Whakarāpopototanga matua

International evidence shows that healthcare associated infections are a significant risk to patients with SSIs identified as being among the highest proportion of these. The consequences of these infections include increased morbidity and mortality as well as prolonged hospital stays and additional interventions and treatment, all of which divert resources away from other areas.

Surveillance can be defined as the ongoing systematic collection, analysis and interpretation of health data essential to the planning, implementation and evaluation of public health practice, closely integrated with the timely dissemination of that data to those who need to know. The final link of the surveillance chain is the application of the high-quality data to infection prevention. The SSIIP uses a quality improvement approach to reducing harm.

This manual provides guidance for the delivery of a national cardiac surgery SSIIP in New Zealand. We hope it will strengthen and standardise data collection.

All five DHBs in New Zealand that perform cardiac surgery are involved in the cardiac surgery workstream, including Auckland DHB's paediatric and congenital cardiac service, which is the sole provider of cardiology and cardiac surgical services for infants and children with congenital and acquired heart disease in New Zealand.

DHBs performing cardiac surgery are supported by the SSIIP team, which provide guidance and facilitates implementation of the SSIIP by:

- testing data collection mechanisms
- focusing on selected cardiac procedures
- providing a manual outlining the data collection process
- providing training and education for cardiac surgery champions
- providing ongoing support with interpretation of definitions
- providing advice on electronic data collection.

4 Establishing a local SSIIP team | Te whakatū i tētahi rōpū SSIIP ki tō takiwā

Each DHB should have an established local SSIIP team, responsible for overseeing the local programme (eg, at individual DHB level). The make-up of the team will vary between DHBs, but it must be multidisciplinary otherwise it will not have the team support it needs to be sustainable. Each member of the team will provide information to enable local data to be collected efficiently.

Surveillance will primarily involve cardiac unit staff and the local IPC team. However, all stakeholders should be offered the opportunity to be represented. Please consider members of the following groups:

- cardiac surgeons
- anaesthetists
- cardiac surgery clinical nurse specialists
- ward and operating theatre-based nurses
- IPC clinical nurse specialists/managers
- clinical microbiologists/infectious disease physicians
- surveillance nurses (where employed for the purpose of surveillance)
- quality managers/clinical audit staff
- IT staff/business intelligence units
- medical laboratory scientists from microbiology departments
- clerical and administration staff
- management representative.

Key roles

Key role 1: Local SSIIP project coordinator

The local SSIIP project coordinator will either be a member of the IPC team or another member of staff with strong links to IPC (eg, a member of the quality/clinical audit team). The key functions of this role are to:

- facilitate the improvement process at a local level
- ensure continuing engagement of the clinical teams and management
- provide overall coordination and liaison with the national SSIIP team
- ensure mechanisms are in place for data collection, collation, transfer and dissemination
- provide local support for staff involved in the improvement process
- facilitate feedback of performance to local stakeholders
- carry out validation processes to verify data.

Key role 2: Data collector

The data collector may be a member of the infection prevention and control team or an individual employed to carry out this role (eg, a surveillance nurse or administrator). The key functions of this role are to:

- collect the data sets in accordance with the SSIIP requirements
- enter or provide the data in a format suitable for uploading onto the online data collection form
- oversee data extraction from unit databases, if required
- undertake quality checks to ensure accuracy of data.

Key role 3: Data transfer coordinator (if using a CSV file to upload bulk forms)

The data transfer coordinator may be a member of administration or IT staff who can upload data to a national SSI form database for analysis. The key functions of this role are to ensure:

- any electronic format utilised locally complies with the SSI database specifications
- data is correctly uploaded into the SSI database.

Key role 4: SSIIP champions

DHBs are asked to nominate at least two individuals, where possible, who will act as 'champions' for the project in their DHB. These individuals should be from key roles 1 or 2 plus a member of the surgical or clinical team involved in cardiac procedures. The role of these champions is to:

- understand and promote the benefits of the programme
- lead by example using the recommended SSII approaches
- share knowledge with fellow SSIIP champions and contribute feedback to improve the programme
- promote quality improvement to drive practice change.

5 Defining SSIs | Te tautohu i ngā SSI

The definitions below are to ensure consistent interpretation and collection of SSI data. The flowcharts in Appendix 1 will also help you make decisions about applying the definitions.

The definitions are those utilised by the National Healthcare Safety Network (Centers for Disease Control and Prevention 2018a, 2018b).

Superficial

A superficial incisional SSI must meet the following criteria:

Infection occurs within **30 days** after the operative procedure (where day 1 = the procedure day)

AND

involves only skin and subcutaneous tissue of the incision

AND

the patient has **at least one** of the following:

a purulent drainage from the superficial incision

b organisms identified from an aseptically obtained specimen from the superficial incision or subcutaneous tissue

c superficial incision that is deliberately opened by a surgeon* and culture or non-culture test not performed **AND** patient has at least one of the following signs or symptoms:

- pain or tenderness
- localised swelling
- erythema
- heat.

A culture-negative finding does not meet this criterion

d diagnosis of superficial incisional SSI by a surgeon.*

* *Also includes other medical practitioners on the case, or their designee (nurse practitioner or physician's assistant).*

Do not report a stitch abscess (minimal inflammation and discharge confined to the points of suture penetration) as an infection.

Do not report a localised stab wound infection (including the cardiopulmonary bypass circuit access site) as an SSI.

Diagnosis of cellulitis by itself does not meet criterion 'd' for superficial SSI.

If the superficial incisional site infection extends into fascia and/or muscle layers, report as a deep incisional SSI only. Infection extending to the sternum (but not involving the sternum) is classified as superficial.

Deep

A deep incisional SSI must meet the following criteria:

Infection occurs within **90 days** after the operative procedure (where day 1 = the procedure day)

AND

involves deep soft tissues of the incision (eg, fascia and muscle layers)

AND

the patient has **at least one** of the following:

a purulent drainage from the deep incision

b a deep incision that spontaneously dehisces, or is deliberately opened or aspirated by a surgeon*

AND

organism is identified by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not active surveillance culture/testing (ASC/AST)) or culture or non-culture based microbiologic testing method is not performed

AND

patient has **at least one** of the following signs or symptoms:

- fever (> 38°C)
- localised pain or tenderness.

A culture- or non-culture-based test that has a negative finding does not meet this criterion

c an abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathologic exam, or imaging test.

* *Also includes other medical practitioners on the case, or their designee (nurse practitioner or physician's assistant).*

Classify infection that involves both superficial and deep incision sites as deep incisional SSI. Infection involving the sternum without osteomyelitis is classified as deep.

Organ/space

An organ/space SSI must meet the following criteria:

Infection occurs within **90 days** after the operative procedure (where day 1 = the procedure day)

AND

infection involves any part of the body, deeper than fascia/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 into the organ/space (for example, closed suction drainage system, open drain, T-tube drain, CT guided drainage)

b organisms are identified from fluid or tissue in the organ/space by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not ASC/AST)

c an abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam,[2] or imaging test evidence suggestive of infection

AND

meets **at least one** criterion for a specific organ/space infection.

For the cardiac SSIIP these are myocarditis, pericarditis, mediastinitis, sternal osteomyelitis and endocarditis. See Appendix 2.

If a patient has an infection in the organ/space being operated on in the first two-day period of hospitalisation and the surgical incision was closed primarily, subsequent continuation of this infection type during the remainder of the surveillance period is considered an organ/space SSI if the organ/space SSI and site-specific infection criteria are met.

Rationale: risk of continuing or new infection is considered to be minimal when a surgeon elects to close a primary wound.

Occasionally an organ/space infection drains through the incision and is considered a complication of the incision. Therefore, classify as a deep incisional SSI.

Please note that organ/space infections occurring more than 90 days following implant cardiac surgery when the patient is an inpatient or is re-admitted to hospital are out of scope for the SSIIP.

2 As defined by the CDC, gross anatomical exam is defined as: 'Evidence of infection elicited or visualized on physical examination or observed during an invasive procedure. Includes physical examination of a patient during admission or subsequent assessments of the patient, may include findings noted during a medical/invasive procedure dependent upon the location of the infection as well as the [National Healthcare Safety Network] infection criterion.' See q 13 at: www.cdc.gov/nhsn/faqs/faq-ssi.html.

6 Reviewing possible cases of SSI | Te arotake i ngā kēhi pea o te SSI

SSI following manipulation of the operative site

An SSI will not be attributed if the following three criteria are ALL met:

- during the postoperative period the surgical site is without evidence of infection
- an invasive manipulation/accession of the site is performed for diagnostic or therapeutic purposes (for example, needle aspiration, insertion of fluid drain)
- an infection subsequently develops in a tissue level which was entered during the manipulation/accession.

More than one operative procedure through the same incision within 24 hours

If a patient goes to the operating theatre more than once during the same admission for another procedure of the same or different procedure category, which is performed through the same incision within 24 hours, report only one procedure form for the original procedure but combine the durations for both, based on the procedure start times and finish times for both procedures, ie, change timing on form. If the wound class has changed, report the higher wound class. If the ASA has changed, report the higher ASA.

Patient dies in the operating room

Do not complete a data collection form because this procedure is excluded from the denominator.

Patient dies after the procedure and date of death is within 90 days of the procedure

Complete a data collection form because these procedures are included in the denominator.

Postoperative infection scenarios

The following scenarios may be useful and aid with interpretation:

- After a patient is discharged from the index hospital, if the incision opens due to a fall or another reason and there was no evidence of incisional infection at the time of opening (as defined by lack of symptoms which make up the definition) then subsequent infection of the incision is not considered an SSI or a healthcare associated infection for the index hospital as this implies a mechanical reason for the dehiscence rather than an infectious reason.

- If a postoperative patient is still hospitalised following surgery and is asymptomatic, and an incision opens due to fall or another reason, eg, patient picking at the wound, it is not considered an SSI.
- If a postoperative patient sustains an injury to the incision area but the incision does not open, but later an incisional infection develops, this is considered an SSI.
- If a postoperative patient has an intact incision (or status is unknown because it is not seen) or it is noted that the patient was incontinent and the incision may have been contaminated, the subsequent incisional infection is considered an SSI.
- If a postoperative patient has a skin condition, eg, dermatitis near intact incision, and then subsequently develops an incisional infection within the follow-up surveillance period, this is considered an SSI.
- If a patient has a remote site infection either before or after an operation or has a manipulation that 'seeds' the operative site (eg, dental work) and later develops deep incisional or organ/space infection during the follow-up surveillance period, this is considered an SSI.

7 Process | Hātepe

Data collection

In this section, we describe the active prospective methods of data collection that participating hospitals should use. Automated data extraction for denominator data is the aim of the SSIIP.

Categories of procedure to be included

Forms for data collection are provided in both hard copy and in an online (web-based) format. Training and education will be provided to orientate staff to the SSIIP. Automation of the process will enable more efficient and accurate data collection and transfer.

The web-based data collection form will be used to record SSI data for the SSIIP and submit to the national programme.

Only cardiac procedures that have a chest incision with a median sternotomy are collected within the programme. If a patient has multiple procedures through the same chest incision then the procedure that takes precedence should be recorded (see section Completing SSIIP data collection forms for patients with multiple cardiac procedures for instructions).

Procedure categories:

- Cardiac surgery (CARD), ie, heart procedures including valves and septum, etc
- Coronary artery bypass graft with chest and donor site incisions (CBGB)
- Coronary artery bypass graft with chest incision only (CBGC).

The programme uses the Australian Classification of Health Interventions (ACHI) to define the procedures in scope. All ACHI codes have seven digits. Table 1 gives an example of ACHI codes and procedure descriptions. See Appendix 3 for the complete list of ACHI codes of procedures for inclusion.

Table 1: Example of ACHI codes and procedure descriptions

Legacy code (category)	ACHI code	Procedure description
CARD	3857101	Replacement of descending thoracic aorta with shunt
CBGB	3849700	Coronary artery bypass, using 1 saphenous vein graft
CBGC	3850000	Coronary artery bypass, using 1 LIMA graft

Procedures such as transcatheter aortic valve implantation (TAVI) are not included, because these do not open the chest, even though the ACHI code may be the same. Only procedures involving a median sternotomy are included in the SSIIP.

Completing SSIIP data collection forms for patients with multiple cardiac procedures

Many cardiothoracic surgery patients, during their procedure, are documented as having more than one procedure code during their single surgery. However, the SSIIP requires only one form per patient because the multiple procedure surgery occurs through one chest incision (with or without a leg or other donor site incision).

Where there is more than one procedure code/ACHI code for a patient, there is a priority for which procedure code to use on the single patient data collection form. CBGB procedures take precedence over CBGC, which itself takes precedence over CARD.

Table 2 shows which procedure code to choose for patients with multiple procedures.

Table 2: Prioritisation of cardiac surgery procedure codes for patients with multiple cardiac procedures

Procedure codes			Form to be completed for which procedure code
CBGB	CGBC	CARD	
✓	✓	✓	CBGB
✓	✓		CBGB
✓		✓	CBGB
✓			CBGB
	✓	✓	CBGC
	✓		CBGC
		✓	CARD

Identification of population for surveillance (denominator)

Include all patients who undergo the selected cardiac procedures (where the chest is opened by sternotomy) funded by the DHB (even if they take place in a private setting) in this surveillance. You may need to review more than one source of data on a regular basis to ensure all eligible procedures are included. These may include the following mechanisms (depending on what is available in each DHB):

- patient management systems which provide details of surgical procedures and readmissions
- operating theatre records
- emergency department records.

Local DHB business intelligence unit teams should be able to assist with this data capture including all procedures that may be funded by the DHB but are performed in private settings. For procedures performed privately the DHB should inform the facility of the data required for this SSIIP and make arrangements for it to be entered into the SSI database.

Notes:

- The denominator for the cardiac surgery SSIIP is the number of patients (not procedures).
- If patients undergo further surgery within 90 days of the original surgery for reasons other than infection, close off the surveillance form relating to the initial operation and start a new one for the new episode of surgery. However, if the later surgery is due to infection, recorded it in the initial SSI form.

Case finding

Begin reviewing patients to identify cases of SSI as close to the date of surgery as possible. To ensure comparable validity of data, those monitoring surgical site wounds must be trained in the definitions and diagnosis of SSI using the standard definitions.

To identify patients in the selected population, the minimum requirement is to have an automated alert or manual check of the following:

- **Operating lists and liaise with staff in the operating theatre**

  Operating lists will provide the details/number of cardiac procedures performed. Some data collection for other reasons may already be in place, so you will need to investigate the most efficient way to collect relevant data.

- **Ward-based reporting of inpatient (during their inpatient stay)**

  The surveillance data collector completes active and systematic review of patients during their inpatient stay. This should ideally involve a review of clinical case records at least once during the inpatient stay.

You will need to liaise with wards caring for the cohort of patients. Ask wards to advise the surveillance data collector if patients in the selected category develop an infection during the admission period. A notification system should be established for this if it is not already in place.

You will need to capture data on patients who return to their referral DHB after cardiac surgery but who develop an SSI. The five DHBs performing cardiac SSI surveillance will have processes in place to ensure they are notified of any SSIs presenting in their catchment DHBs.

Once cases have been identified, the following checks are needed:

- **Readmission surveillance**

  Readmission within 90 days of the surgical procedure. Use hospital databases to identify all patients (within a defined patient population) who have been readmitted within 30 and 90 days of the procedure. Input from local project IT or business intelligence unit staff may be required.

  You can use ICD-10-AM coding to assist with this as the following codes are used to indicate infection and inflammatory reaction following cardiac surgery:

Code	Reaction
I33.0, I33.9 or I97.8 and I33.0 or I33.9	Endocarditis (assuming acute or subacute and not rheumatic)
J98.5 or J95.8 and J98.5	Mediastinitis
M86.x8 (where x is any digit) or M96.8 and M86.x8	Osteomylitis (bones of head, neck, ribs, trunk, vertebral column)
T81.3 (wound only) or T85.6, T85.88 (due to sternal wires)	Sternum dehiscence
T81.3	Wound dehiscence
T81.41	Wound infection following procedure
T81.41	Donor site infection (no distinction between donor site from recipient site)
T81.42	Sepsis following a procedure
T85.78	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts

Procedure codes:

Code	Procedure
3863700	CABG only
3864000	Other cardiac procedure
9059600 or 384660	Sternum only, eg, rewiring
9068601, 9066500, 3002300, 3002301	Debridement wound (note these codes are used for traumatic wounds as well as operative wounds)

Wards likely to receive patients re-admitted with SSI should be identified and contacted regularly to ask about patients readmitted with SSI. There should be a mechanism in place where the operating DHB informs all referring DHBs of patients who have had cardiac surgery. All referring DHBs must check out to 90 days to ensure there has been no readmission with an SSI. If there has been admission with an SSI they must collect all SSI data and forward to the operating DHB for data entry.

- **Microbiology request surveillance**

  All patients with a suspected infection should have appropriate clinical specimens collected for microbiology before the administration of antibiotics. The clinical team are responsible for obtaining these and we remind clinicians of the importance of obtaining samples. We recommend tissue and aspirate rather than simply a swab.

- **Positive culture of a significant organism from the procedure site**

  Regularly review microbiology reports to identify any positive surgical site cultures from patients in the surveillance population. Where possible, this should be by an automated process via the microbiology IT system. However, if this is not possible, you will need to review electronic microbiology records of patients in the cohort. In patients who have a relevant specimen (eg, aseptically obtained culture of fluid or tissue from the incision), review records to determine if the culture is of significance (ie, confirms diagnosis of an SSI).

- **Subsequent review/confirmation of cases**

  If you identify any of the above, the surveillance data collector will need to review the patient's records including temperature charts to confirm diagnosis of SSI using the surveillance definitions.

  For procedures that fulfil the criteria for SSI in accordance with the definitions, complete the additional SSI minimum data set in the web-based data collection form. Once the form has been updated with the additional infection data (numerator), save and send it to the national monitor.

  Users of an electronic IPC management system (eg, ICNet) may use re-admission and microbiology reports and/or alerts to identify possible SSI cases and complete the numerator section data.

Procedures performed at other hospitals

If the patient meets the criteria for SSI but the procedure was performed at a referral cardiac service, then the IPC staff at the hospital where the operation was originally performed must be notified. The relevant information that has been collected about the patient and the SSI must be sent to the referral hospital. The referral hospital is responsible for completing the SSI data and entering this into the online form.

Post-discharge surveillance (PDS)

The SSIIP does not include PDS due to the difficulty identified with standardisation of the process. Excluding PDS will underestimate the true level of SSIs (as some superficial wound infections will not be included), however, if you wish to perform PDS you may do so and use the data for local review but it will not be included in the national rates for comparison.

Continuous surveillance

The surveillance of cardiac surgery cases will be on a continuous basis to ensure ongoing analysis of SSI incidence.

Data set

This section defines each question in the surveillance data set.

Please complete demographic and surgical denominator data for all patients included in the surveillance. Only complete the infection data (numerator) for those patients that develop SSI that meets the case definitions.

Note: We recommend completing the surgery (denominator) data in the data collection form for each procedure at 30 days and then amending this only if subsequent infection is reported at 90 days. Submitting the data collection forms to the SSI national reporting system (national monitor) monthly allows DHBs to complete validation using the standard reports and run monthly reports on compliance with the interventions to provide feedback to the local SSIIP team and inform quality improvement.

Patient information (denominator data)

Wherever possible, source this information from the patient administration system, the patient's record and theatre records.

Form ID	*Unique identifier – pre-populates.* *Can be referenced in emails to the SSIIP if enquiring about a form.*
DHB ID	*Pre-populates.* *This will be the recognised abbreviation for the DHB.*
Facility ID (Hospital)	The participating DHB will designate hospital/s from which patients will be entered. The codes used for this will be pre-populated in the online form and are those which are used nationally for New Zealand hospitals.
Patient NHI	National Health Index number consisting of alpha/numeric format (AAA1234). Double-check the NHI number to be sure data is accurate.
Gender	Male, female, or unknown.
Date of birth	DD/MM/YYYY Double-check the date of birth to be sure data is accurate.

Primary admission/discharge data

Date of admission	DD/MM/YYYY The admission date is the date when the patient is admitted to the DHB facility, not simply the date of admission to the operating hospital. If they are admitted to one hospital and then transferred to the operating hospital, record the date of initial admission.
Date of discharge	DD/MM/YYYY The discharge date should be the date the patient finally leaves the DHB health care facility; the day they go home. If they transfer from the operating hospital to another health care facility (eg, DHB rehabilitation facility) then they are still considered an inpatient; the discharge date is the date they leave the DHB facility (not the date they leave the operating hospital). However, in some cases, where automated imports populate the data collection form and the date of discharge is the date of discharge from the operating hospital, then this is acceptable.
Date of death (if applicable)	DD/MM/YYYY If the patient is still alive this is a null field. If the patient dies in the operating room do not complete a data collection form. This procedure is excluded from the denominator.

Note: Where a date is required, a calendar format will appear for ease of date entry.

Procedure

Date of procedure	DD/MM/YYYY Double-check the date of procedure to be sure data is accurate.
Procedure code/category (Operative code/legacy code)	CARD/CBGB/CBGC Select priority category if patient underwent multiple procedures.
Procedure description and ACHI code	Choose one from the dropdown list of surgeries. See Appendix 3 for list of procedure descriptions.
Is operation due to infection?	Yes/No/Unknown
Is this procedure an emergency?	Yes/No/Unknown Non-emergency procedures are those that have been planned at a time to suit the surgeon and the patient. This includes those that may have been emergency admissions but have either been delayed or there is time to carry out pre-operative preparation. Emergency procedures include unplanned, immediate procedures conducted as soon as possible after initial recovery from trauma/emergency admission.
Surgeon grade	First surgeon. Select from the following: consultant/specialty registrar/locum consultant/locum registrar/other.
Surgeon code	First surgeon. Use unique surgeon code that is known by the facility only.

Risk score data

The total surgical risk score will be automatically calculated provided the fields below are completed.

Wound class	Choose from the following: **Clean:** An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital or uninfected urinary tracts are not entered. Almost all cardiac procedures will be clean operations. **Clean–contaminated:** Operative wounds in which the respiratory, alimentary, genital or urinary tracts are entered under controlled conditions and without unusual contamination. Note: this category would be very rare for cardiac procedures. **Contaminated:** Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract and incisions in which acute, non-purulent inflammation are encountered. Note: this category would be very rare for cardiac procedures. **Dirty or infected:** includes old traumatic wounds with retained devitalised tissue and those that involve existing clinical infection or perforated viscera. This definition suggests the organisms causing postoperative infection were present in the operative field before the operation. Note: this category would be very rare for cardiac procedures.
Operation start (knife to skin)	HH/MM, 24-hour clock Used to calculate length of operation to determine risk index. If actual knife to skin time is not recorded, use theatre start time.
Operation finish (skin closure)	HH/MM, 24-hour clock Used to calculate length of operation to determine risk index. If actual skin closure time is not recorded, use theatre finish time. **Note:** Where there is more than one operative procedure through the same incision within 24 hours amend operation finish to give a combined duration. If using a CSV file to submit data, this must be altered manually.
Duration	*This will be automatically calculated.*
ASA score	1/2/3/4/5/Not recorded This is used to determine total surgical risk score (see Appendix 4) and is an important item to collect. It is usually found in the operation notes. 1 A normally healthy patient. 2 A patient with mild systemic disease. 3 A patient with severe systemic disease. 4 A patient with severe systemic disease that is a constant threat to life. 5 A moribund patient who is not expected to survive without the operation.

Anaesthetic

Type of anaesthetic	Select from the following: • General • Other • Not recorded.

Pre-operative information

Time in hospital before surgery	*Date of surgery minus date of admission in whole days. This will be automatically calculated.*
Diabetes mellitus	Type 1/Type 2/No/Unknown **Type 1 diabetes** Type 1 diabetes is when your body has stopped producing insulin. People with type 1 diabetes need to inject insulin to live. • Type 1 diabetes is usually diagnosed in children. • Type 1 diabetes is less common than type 2 diabetes. **Type 2 diabetes** Type 2 diabetes is when your cells have become insulin resistant or your body doesn't produce enough insulin to keep you healthy. • Type 2 diabetes usually develops in adults but it is becoming more common in children. • Type 2 diabetes is the only type of diabetes linked with obesity.
Current smoker	Yes/No/Unknown
Hair removal	Clipping/Shaving/Other/Unknown

Antibiotic prophylaxis

Pre-operative antibiotics	
Was antibiotic prophylaxis given?	Yes/No/Unknown If Yes, the following fields must be completed. If No, continue to intra- and postoperative antibiotic section.
Name of antibiotic/s Enter up to three antibiotics separately	Recognised (generic) name of the antibiotic agent(s) used: • cefazolin • cefuroxime • clindamycin • flucloxacillin • gentamicin • vancomycin • other, please specify. Always record cefazolin and vancomycin if used. **If cefazolin is used, always record as antibiotic 1**. Compliance with the dose quality and safety marker is calculated off antibiotic 1. If antibiotic is not on the list, choose other and then enter the name in the free text field that will open.
Date given	*Pre-populated from date of procedure.*
Time given	HH/MM, 24-hour clock
Dose	Enter the dose into the free text box.
Dose unit	Choose from Grams/Milligrams/Unknown.
When was it administered?	Choose from: • Within one hour prior to incision • More than one hour prior to incision • On induction • After incision • Not recorded. If 'time given' is entered one of the above options will automatically populate based on calculated knife to skin time.
Intra-operative antibiotics	
Additional dose on bypass	Yes/No/Unknown/Not applicable Choose 'Not applicable' if non-bypass procedure.
Was an additional dose of antibiotic given intra-operatively, eg, for lengthy procedure?	Yes/No/Unknown Initial antibiotics are regarded as 'pre-operative' and their timing in relation to knife to skin is recorded. Intra-operative doses are defined as those given after initial and any bypass dose.

Postoperative antibiotics (within first 48 hours)	
Were antibiotics given postoperatively?	Yes/No/Unknown
(If Yes) Were they given for **less than** 48 hours?	Yes/No/Unknown Standard postoperative dosing is six doses of cefazolin given eight-hourly for cardiac surgery. If six doses are charted postoperatively this is accepted as being for less than 48 hours. If this is exceeded, then the response is no.

Surgical skin preparation

Surgical skin preparation	Select from the following: • Chlorhexidine and alcohol • Povidone-iodine and alcohol • Aqueous povidone-iodine • Aqueous chlorhexidine • Other (dropdown choices will be added for other agents. Please contact the SSIIP team to have other agents added to the dropdown menu) • Unknown.

Patient BMI

Patient BMI	Patient height: Enter height in m if known or select unknown. Patient weight: Enter weight in kg if known or select unknown. BMI: Calculated from height and weight if entered, or enter BMI alone if it is known.

Postoperative information

Delayed chest closure Sternum open at end of procedure	Yes/No/Unknown
Return to theatre Another chest procedure during initial admission	Yes/No/Unknown If returned to theatre within 24 hours, amend the timing for duration to the combined duration.
Post-op glucose control	Yes/No/Unknown

Pre-operative anti-staphylococcal bundle

Did the patient receive anti-staphylococcal bundle?	No bundle protocol/Yes/No/Unknown
If pre-screening was performed on the patient what was the result? (Select 'MRSA Positive' if mixed result)	Select from the following: • Not applicable (No pre-screening performed) • No *S. aureus* • MSSA Positive • MRSA Positive • Unknown.
Skin decolonisation – compliance	Select from the following: • Full compliance (all doses) • Partial compliance (some doses) • Not compliant (no doses) • Not applicable (skin not part of bundle) • Unknown.
Nasal decolonisation – compliance	Select from the following: • Full compliance (all doses) • Partial compliance (some doses) • Not compliant (no doses) • Not applicable (nasal not part of bundle) • Unknown.

Re-admission details

Has the patient been re-admitted due to an SSI?	Yes/No
If yes, date of re-admission for SSI?	DD/MM/YYYY

Numerator data

SSI details

Has SSI criteria been met for this procedure?	Yes/No (if Yes, complete the numerator data section). Note: The data collection form can be sent to the national monitor at this stage to utilise the reporting functionality. To do this you must answer 'No' to this question and if, in following the 90-day follow-up period (30 days for superficial SSI) the criteria for SSI is met, update to 'Yes', add additional infection data and re-send to the national monitor.
SSI site	Tick one of the following: • Chest only • Donor site only • Both sites.
When SSI diagnosed?	Select from the following: • During initial admission • During re-admission up to 30 days post-procedure • During re-admission up to 90 days post-procedure.
Date of infection	DD/MM/YYYY The date of diagnosis must be entered. This will be when sufficient criteria for SSI have been met. If date is unclear and patient has been re-admitted enter the re-admission date.
Type of SSI	Check the flowcharts (Appendix 1) to assist with decision-making before completing this section. Choose one of the following: • Superficial (must occur within **30 days** post-procedure) • Deep (must occur within **90 days** post-procedure) • Organ/space (must occur within **90 days** post-procedure). When organ/space is chosen, you also need to identify which type: • Myocarditis • Pericarditis • Mediastinitis • Sternal osteomylitis • Endocarditis. When calculating days, day 1 is the day of procedure.

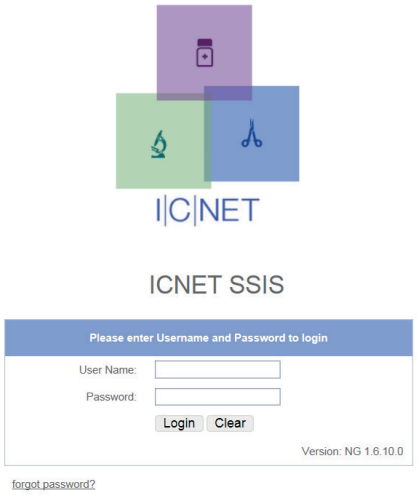
Microbiology

Was a clinical sample taken?	Yes/No
Type of sample	Select from the following: • Blood • Tissue • Aspirate • Wound swab • Other. Up to three clinical samples can be entered on the online form.
Clinically significant organism identified?	Yes/No Note: Careful interpretation is needed to ensure only those isolates considered to be the cause of infection are recorded. Consultation with a medical microbiologist or infectious diseases consultant is advisable.
If Yes, identify organism	Select organism from the dropdown list. Select from the following: • *Acinetobacter baumanii* • *Candida albicans* • *Enterococcus faecalis* • *Enterococcus faecium* • *Escherichia coli* • *Klebsiella oxytoca* • *Klebsiella pneumonie* • *Pseudomonas aeruginosa* • *Serratia marcescens* • *Staphylococcus aureus* • *Staphylococcus epidermidis* • *Streptococcus pyogenes* (Gp A) • *Streptococcus agalactiae* (Gp B) • Other – use the online menu to select the organism • Not specified. Note: If the SSI is due to a mixed infection, record the organisms by using the 'site of sample' boxes more than once to enter the different isolates.
Is the organism an MDRO?	Yes/No If Yes, indicate which of the following: • MRSA • ESBL • VRE • CRO – includes CRO, CRE, CPE, NDM • Other. Note: The patient may have multiple infections. You can select any or all of these.
Notes	For your own reference if required. These are not reviewed by the SSIIP team.

Data collection tools

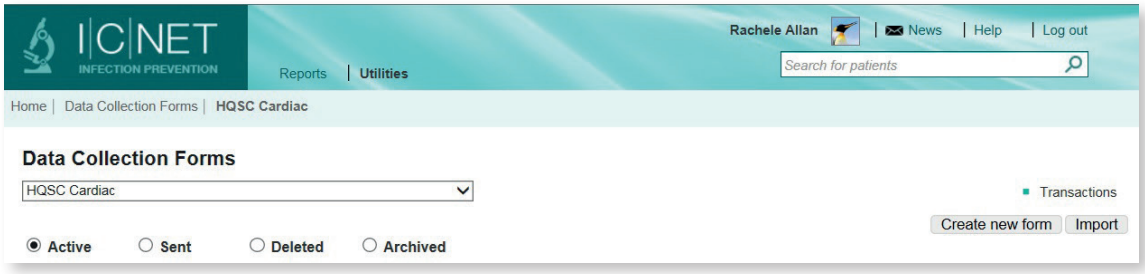
Note: Data collection tools are available in both paper and electronic (online versions). The paper-based version is available in Appendix 5.

Once data has been collected, enter it into the SSIIP online database (ICNet data collection forms). Training will be provided on how to use the system and complete the online form. Ongoing advice is available via the national SSIIP team. All delegated improvement staff in DHBs will be given a user account to access the site. This is linked to their DHB and hospital/facility details.

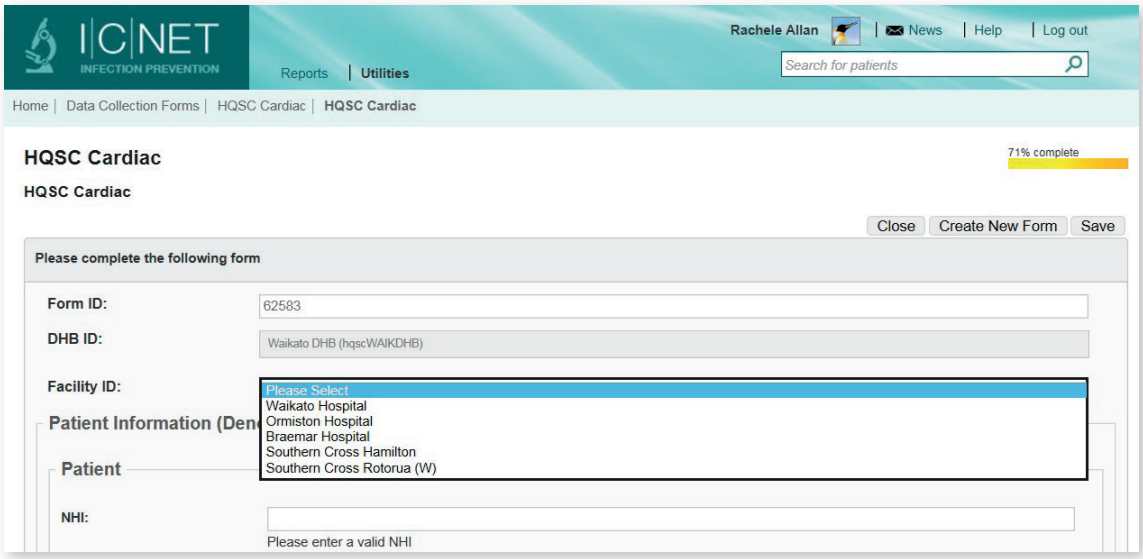


Entering patient data

Once you have successfully logged in, the database will be accessible for entering the patient data. Create a new form for each procedure via the 'create new form' button. This will open up the data fields for data entry. There are some mandatory fields, which you must complete before the form can be uploaded as a procedure case. Once a form has been created, it can be 're-opened' at any stage to enter additional information about the case, for example, re-admission or SSI details.



Once opened, a form will automatically be allocated a record number (Form ID). This can be recorded on any hard-copy version of the form you may hold as a cross-reference. When a new form is created, your DHB will be auto-populated (linked to your login) and you will then need to select the hospital where the patient underwent the procedure. The form completion is straightforward; fields that require data to be completed are highlighted in pink when they remain empty.



Saving data entry

Each time you enter data you will need to actively save it using the 'save' button on the top right of the screen. If you close the form without first saving it, your data will be lost. If you have multiple data entries to complete, you can use the 'save' button and then go straight to 'create new form'.

Deleting forms

If you no longer need a form that has been partially completed and the form is still in the 'active' folder, you can re-allocate the form by overwriting the data with another patient's data.

If you no longer need a form that you have already 'sent' to the national monitor, the form can be deleted, but only by an ICNet administrator. In this case, email the administrator (ICNetSupport@cdhb.health.nz) with the Form ID and ask for the form to be deleted.

Completion of data entry for each case

When a new form is opened it will show that it is already 73 percent complete, even though you have not yet entered any data. This is due to the optional data fields that are contained in the form from the outset. As you enter data the percentage completed will rise until all mandatory fields are completed. The percentage indicator at the top of the form then changes to green and indicates it is 100 percent complete. A case may be 'completed' on the online form for the following reasons:

- All surgery data complete – infection data to be added later following case review*
- No wound infection reported up to 30 days post-procedure
- No wound infection reported up to 90 days post-procedure.**

* This allows a DHB to utilise the reporting in the national monitor rather than waiting until the quarterly report is published.

** When a case is completed at 30 days it will remain in the system and can be re-opened should the patient be re-admitted with an SSI within 90 days of the procedure date. Hence DHB must have mechanisms to check for re-admissions 90 days after the procedure.

If you have any trouble logging into the SSI data collection form or entering data please email ICNetSupport@cdhb.health.nz.

Please log all other enquiries through the SSIIP team – SSIIP@hqsc.govt.nz. Do not contact ICNet directly.

8 Assurance | Whakataurangi

Validity of data/quality assurance

Interventions to improve health care outcomes rely on robust measurements and clinician confidence in the data being reported. Therefore, surveillance data collected for the SSIIP must be validated.

The local SSIIP project coordinator is responsible for data validation. They should:

- ensure patient demographics and other data for submission are correct
- verify that all eligible patients are included (ie, the denominator data is complete)
- audit the interpretation of variables, such as infection/no infection and the classification of SSI
- assess the competency of staff and structure within the DHB in order to ensure they are able to perform the tasks required for the SSIIP.

The following validation methods are based upon protocols from Scotland (Health Protection Scotland 2011) and England (Health Protection Agency 2008).

Validation of data for the SSIIP

Stage of data collection	Information	Methods
Transcription from paper to online form	All data	Audit of 10 percent of forms each quarter.
Online data collection form/local ICNet data collection form	NHI Date of birth Dates Complete data	Linked to database to check patient demographics (not currently available). Double-check NHI at time of entry. Double-check DOB at time of entry. DOB cannot be after date of procedure. Dates for operation and discharge cannot be before admission date. Operation finish cannot be before operation start time. Online form indicates percentage of completeness of each form.
Following submission to national monitor	Outliers/abnormal data Age Numerator Denominator Compliance with programme interventions including QSMs Paediatric procedures	A series of reports have been made available to the DHB to support data review and validation. DHBs should run the reports with prefix 'QCK' (quick check) to review data input and identify any abnormal results. If a data entry issue is found, this should be corrected in the data collection form and re-sent to the national monitor. QCK reports should be run at least each quarter in the 30 days following the close of the 90-day period. To reduce the burden of data review we recommend submitting SSI data and running QCK reports monthly.
Eligible patients	Type of surgery	Check the ACHI/ICD-10 codes for surgery and readmission/operating lists/ microbiology results/pharmacy records.
SSI definition	SSI definition interpretation	Use of algorithms in manual. Check with another member of local SSIIP team. Check with national SSIIP team where necessary (for complex cases). Refer to published case studies.
Case detection	Initial admission and re-admission	Robust methods to detect SSIs. Refer to case finding section.
Local SSIIP (in DHB)	Data collection/ structure/education related to the national SSIIP	External audit of all processes, structure and competency within the DHB for submission of data to the SSIIP.

Confidentiality

The SSIIP follows strict confidentiality and privacy regulations.

Data collection

Data collected as part of the SSIIP shall be obtained and held in accordance with the:

- Health Information Privacy Code 1994
- Health Act 1956
- Privacy Act 1993
- Official Information Act 1982
- Code of Health and Disability Services Consumers' Rights.

The information is also covered by the confidentiality/privacy policy of each DHB.

The information collected through the online form will be stored in a central database that will be:

- held in the strictest confidence
- used only for the stated purpose.

Each DHB can only access their own data.

The only patient-identifiable data that is collected as part of the SSIIP should be the NHI and date of birth.

The SSIIP will not send patient-identifiable data by email. DHBs can access/download their data by logging into the system. When querying a case/procedure, refer to the Form ID in correspondence.

Access to the online data collection form

Designated data entry staff will need a password to access the online form. Collection/storage of any data stored locally will be in accordance with local policies. Each person must have their own login and comply with the Canterbury District Health Board's 'General conditions for access to information systems'. Contact ICNetSupport@cdhb.health.nz if you need a copy of the conditions.

The local coordinator is responsible for ensuring all data submitted is anonymous, including the surgeon performing the operation. Codes must be used to identify surgeons at a local level.

Reporting

The SSIIP generates reports both for local use as well as national data to allow comparison between DHBs. Through these reports, we can evaluate the value of local as well as national improvement interventions.

National reports

Quarterly reports of infection rates and compliance with the SSIIP evidence-based interventions including national and local DHB data will be generated each quarter. This data should be circulated to all stakeholders to facilitate discussions on improvements. Data can then be examined locally by IPC committees and surgical colleagues.

An annual report of the results of SSI surveillance will be published with analysis of the results for a year. This report will have a focus on the risk factors for SSI.

Using reports for quality improvement

Measurement and using collected data for improvement are critical parts of testing and implementing changes because they tell a team whether the changes being made are actually leading to improvement. Reviewing data provides your team with a picture of where you are starting from and where you are heading.

We have included in Appendix 6 an overview of the IHI's Model for Improvement (Institute for Healthcare Improvement 2012). The SSIIP recommends providers use the Model when undertaking improvement projects and activities. It is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organisations internationally.

Given the complexity of reducing the outcome measure of SSI, in Appendix 6 we offer several tips and suggestions for any SSI-related improvement activities.

9 Interventions | Ngā wawao

Surgical antimicrobial prophylaxis intervention guidelines

One of the most important interventions in preventing SSI is the optimisation of surgical antimicrobial prophylaxis (Classens et al 1992). Surgical antimicrobial prophylaxis is the use of antibiotics to prevent SSI. It should be distinguished from the use of antibiotics in early treatment, where infection is already established, although not necessarily evident pre-operatively.

Appropriate use of surgical antimicrobial prophylaxis

Antimicrobial prophylaxis may be beneficial in surgical procedures associated with high rates of infection such as clean-contaminated or contaminated procedures. It may also be beneficial in clean surgery where prosthetic devices are implanted, because although the infection rate is low, the consequence of infection is severe. Prophylaxis is recommended for cardiac surgery (Bratzler et al 2013).

An optimal surgical antimicrobial prophylaxis regimen that helps to reduce the risk of SSI ensures that patients receive **ALL** of the following:

- **correct antimicrobial choice and dose:** first line of choice for adult cardiac surgery is a ≥ 2g dose of cefazolin (and 30 mg/kg for paediatrics).
- **correct antimicrobial timing:** antimicrobial prophylaxis is administered as a single dose 0–60 minutes before knife to skin.
- **correct duration:** prophylaxis is discontinued within 48 hours of surgery end time (six additional doses at eight hourly intervals).

Data collected by the SSIIP is also fed into the Commission's quality and safety markers (QSM) reports, which are published on a quarterly basis. There are two QSMs associated with the use of surgical antimicrobial prophylaxis:

1. DHB performance is measured against selection of the correct antimicrobial choice and dose (≥ 2 g of cefazolin for adults and 30 mg/kg for paediatrics), **with a compliance target of 95 percent**.
2. DHB performance is measured against the correct antimicrobial timing (within 60 minutes of knife to skin), with a **compliance target of 100 percent**.

Correct antibiotic choice and dose

The first choice for surgical antimicrobial prophylaxis for adults undergoing cardiac surgery is a ≥ 2 g dose of cefazolin.

For paediatric patients the cefazolin dose is 30 mg/kg, not to exceed the adult dose.

- Clindamycin (600 mg) or vancomycin (1 g up to 70 kg and then 15 mg/kg for patients weighing more than 70 kg) should be reserved as alternative agents in the event of allergy to ß-lactam agents. Paediatric doses for clindamycin is 10 mg/kg and vancomycin 15 mg/kg, neither to exceed the adult dose.
- Vancomycin should be included with cefazolin for routine prophylaxis for patients known to be colonised with MRSA.

The recommended dose of cefazolin for ALL adults (≥ 18 years) is 2 g

It is unclear if the dose of cefazolin for those patients weighing > 120 kg should be increased to 3 g. A number of studies, all with differing design, have looked at this issue and provide conflicting conclusions (Forse et al 1989, Edmiston et al 2004, Koopman et al 2007, van Kralingen et al 2011, Ho et al 2012).

Rationale	This measure assesses whether DHBs are complying with evidence-based practice
Improvement	An increase in the rate of compliance, ie, xx percent of patients (≥ 18 years) received cefazolin ≥ 2 g as their first choice of antimicrobial
Numerator statement	Number of adult patients who underwent a cardiac procedure where a ≥ 2 g dose of cefazolin was administered
Denominator statement	Number of adult patients who underwent a cardiac procedure
Collection guidance	If cefazolin is used record as the first antibiotic

Correct antibiotic timing

Administer surgical antimicrobial prophylaxis 0–60 minutes before knife to skin as a single dose.

- Evidence indicates that antimicrobial prophylaxis should be given within the 60 minutes before the surgical incision (knife to skin) (Classens et al 1992).
- For patients who receive vancomycin, to allow adequate time for the infusion to occur, initiate the antibiotic within two hours before the surgical incision. The infusion should be completed before knife to skin.
- An additional 1 g dose of cefazolin or 600 mg of clindamycin is given on starting bypass. Additional dosing of vancomycin on bypass is not required.
- An additional dose of cefazolin may be necessary if the length of surgery is prolonged. It is recommended that re-dosing occurs when the length of the procedure exceeds two half-lives; as this is 1.2–2.2 hours for cefazolin, re-dosing should occur four hours after the first dose is given.
- Also consider re-dosing if there is excessive blood loss (> 1,500 mL) so there is an adequate antimicrobial level until wound closure.

Rationale	This measure assesses whether DHBs are complying with evidence-based practice
Improvement	An increase in the rate of compliance
Numerator statement	Number of patients who underwent a cardiac procedure in which antimicrobial prophylaxis was given within one hour prior to surgical incision (vancomycin infusion completed before incision)
Denominator statement	Number of patients who underwent a cardiac procedure
Collection guidance	This is a Yes/No question. Was antimicrobial prophylaxis given within 60 minutes of knife to skin? If antimicrobial was not administered or time of recording was not documented, count this case as one in which the patient was not given the antimicrobial on time, ie, count as an error

Correct duration

Discontinue surgical antimicrobial prophylaxis within 48 hours after surgery end time.

- Data and clinical practice guidelines do not support antimicrobial prophylaxis continuing beyond 48 hours for cardiac surgery (Bratzler et al 2013). There is also no evidence for benefits of continuing antimicrobial administration until all drains or catheters are removed.
- Six doses of cefazolin administered eight hours postoperatively is accepted as discontinuation within 48 hours of surgery.
- The use of antimicrobials is not without risk for patients. Exposure to antimicrobials is associated with a greater risk of subsequent colonisation with resistant organisms.
- Antimicrobial use is a risk factor for *Clostridium difficile*-associated disease.

Rationale	This measure assesses whether DHBs are complying with evidence-based practice
Improvement	An increase in the rate of compliance
Numerator statement	Number of patients where antimicrobial prophylaxis was discontinued within 48 hours after surgery end time
Denominator statement	Number of patients who underwent a cardiac procedure
Collection guidance	This is a Yes/No question. Was prophylaxis discontinued within 48 hours of the end of surgery? Exclude patients in whom antimicrobials are continued as treatment from this measure

Implementing surgical antimicrobial prophylaxis

In implementing the three components for appropriate use of antimicrobial prophylaxis we suggest clinicians consider the following where appropriate/applicable to their DHB:

- Engage with the anaesthesia service to ensure the correct antimicrobial agent, timing and dose for perioperative prophylaxis occur.
- Use pre-printed or computerised instructions specifying postoperative antimicrobials and timely discontinuations.
- Use electronic prescribing order sets or pathways to direct to the appropriate antimicrobials and timely discontinuation.
- Change operating room medicine stocks to include only recommended antimicrobial agents.
- Use visible reminders/checklists/stickers.
- Involve pharmacy, IPC, clinical microbiologists and infectious disease physicians to ensure appropriate timing, selection and duration.
- Verify administration time during a specified 'time out' period (eg, five minutes) so action can be taken, if not administered.
- Use ward rounds and consider using pharmacist involvement to ensure antimicrobials are stopped within 48 hours of surgery.

Implementing the interventions to prevent SSI for cardiac surgery presents an important opportunity to build collaboration within the hospital setting, including the following:

- Enlist the support of senior leadership in the hospital and surgical and anaesthesia departments.
- Identify one or two surgeons and anaesthetists to further champion the case and influence peers to encourage the adoption of, implementation of and adherence to the above interventions.
- Explore how best to communicate the interventions through strategies such as face-to-face communication at staff meetings, outreach to surgeons' offices, or telephone calls from leaders to their peers.
- Build collaborative relationships between the hospital operating room management team (operating room (OR) nurses, anaesthetists and anaesthetic technicians) and surgeons to establish reliable processes and handovers for pre-operative assessment, planning and follow-up.

Skin antisepsis preparation intervention guidelines

Pre-operative skin antisepsis is a simple and effective measure to reduce the risk of SSI (Maiwald & Chan 2012). The primary source of organisms contributing to infection following surgery is the bacteria on a patient's skin. The aim of skin antisepsis is to eliminate and rapidly kill skin flora at the site of a planned surgical incision (Canadian Patient Safety Institute 2011).

Antiseptics can be defined as biocidal products that destroy or inhibit growth of microorganisms in, or on, living tissue, for example, the skin. Antiseptics can include a wide variety of formulations and preparations including hand washes, surgical scrubs, pre-operative skin preparations, ointments, creams, tinctures, mouthwashes and toothpaste. Overall, they should have the following characteristics:

- a wide spectrum of activity against bacteria, fungi and viruses
- rapid biocidal activity
- little or no damage, irritation or toxicity to the tissue
- little or no absorption into the body
- if possible, some persistent biocidal activity.

Pre-operative skin preparation of the operative site involves use of an antiseptic agent with both rapid and long-acting antimicrobial activity. Two types of pre-operative skin preparations that combine alcohol (which has an immediate and dramatic effect on skin bacteria) with long-acting antimicrobial agents appear to be more effective at preventing SSI (Institute for Healthcare Improvement 2012):

- chlorhexidine gluconate plus alcohol (at least 70%)
- povidone-iodine plus alcohol (at least 70%).

Appropriate use of skin antisepsis preparation

Evidence supports the use of surgical skin antisepsis preparation for all classes of surgery.

Alcohol, chlorhexidine and povidone-iodine (iodine tinctures or iodophors) are the most commonly used antiseptic agents. An optimal surgical skin antisepsis preparation regimen, that helps to reduce the risk of SSI, ensures that patients receive an alcohol-based antiseptic solution (at least 70%) containing one of the following antiseptics:

- chlorhexidine gluconate OR
- povidone-iodine.

The immediate killing activity of alcohol requires that the alcohol evaporates. Adequate drying time is required for killing to occur.

Alcohol-based chlorhexidine and povidone-iodine antiseptic solutions significantly reduce the likelihood of surgical site colonisation and maximise the rapidity, potency and duration of bactericidal activity when compared with other solutions.

Data collected for this intervention is also reported as a QSM. DHB performance is measured against use of one of the above alcohol-based skin preparation agents. The compliance target for this QSM is 100 percent.

Skin antisepsis preparation: Either alcohol and chlorhexidine or alcohol and povidone-iodine is used.

Rationale	This measure assesses whether DHBs are complying with evidence-based practice
Improvement	An increase in the rate of compliance, ie, xx% of patients receiving skin antisepsis with alcohol (at least 70%) containing either chlorhexidine or povidone-iodine
Numerator statement	Number of patients where a skin antisepsis with alcohol (at least 70%) containing either chlorhexidine or povidone-iodine was used
Denominator statement	Number of patients who underwent a cardiac procedure

Chlorhexidine gluconate

The properties that make chlorhexidine highly effective are a strong affinity for binding to the skin, high antibacterial activity and prolonged residual effects on rebound bacterial growth. Chlorhexidine exhibits excellent activity against gram-positive and good activity against gram-negative vegetative organisms and fungi (APIC 2010).

Chlorhexidine is typically used in concentrations of 2%–4% for hospital scrubs and hand washes, however, when the formulation includes alcohol, the concentration of chlorhexidine is usually 0.5%–2.0%.

For patients who are allergic to chlorhexidine gluconate, use povidone-iodine with alcohol (at least 70%) as an alternative.

Povidone-iodine

Iodine has been widely used as an antiseptic. Traditional solutions in water or alcohol include tincture of iodine or Lugol's solutions. Iodophors are preparations containing iodine complexed with a solubilising agent such as a surfactant or povidone (povidone-iodine (PVP)). Iodophors have allowed for greater flexibility in the use of iodine in antiseptics. Depending on the concentration of free-iodine, iodophors can be used for routine and high-risk applications such as surgical scrubs and pre-operative skin antisepsis. They are generally associated with low toxicity and little irritation. The concentration of iodine depends on the formulation used. For example, one formulation contains iodine povacrylex (0.7% available iodine) and 74% weight to weight (w/w) isopropyl alcohol.

Implementing surgical skin antisepsis preparation

While fires in the operative theatre are extremely rare, alcohol-based antiseptics are flammable, therefore we recommend you take the following precautions when using alcohol-based antiseptic skin preparation solutions:

- Staff need to be educated before using a chlorhexidine gluconate-alcohol or povidone-iodine-alcohol solution on how to be safe and effective in their application of a flammable skin preparation agent.
- Avoid dripping or pooling of alcohol-based antiseptic solutions on sheets, padding, positioning equipment, adhesive tape and on or under the patient.
- Ensure the liquid has completely dried by evaporation – three minutes is usually enough time. Areas with excess hair may take longer to dry. Evaporation is essential for the biocidal activity of alcohol.
- Develop protocols that ensure and document the applied solution is completely dry before draping the patient.
- Single-use applicators should ideally be used to apply flammable antiseptic agents.
- Cleanse the incision area for 30 seconds and then paint the rest of the area.
- Consider use of a tinted chlorhexidine gluconate-alcohol preparation (orange, red or teal) for greater visibility.

Implementing the interventions to prevent SSI for cardiac surgery presents an important opportunity to build collaboration within the hospital setting, including the following:

- Enlist the support of senior leadership in the hospital and surgical and anaesthesia departments.
- Identify one or two surgeons and anaesthetists to further champion the case and influence peers to encourage the adoption of, implementation of and adherence to the above interventions.
- Explore how to best communicate the interventions through strategies such as face-to-face communication at staff meetings, outreach to surgeons' offices, or telephone calls from leaders to their peers.
- Build collaborative relationships between the hospital operating room management team (OR nurses, anaesthetists and anaesthetic technicians) and surgeons to establish reliable processes and handovers for pre-operative assessment, planning and follow-up.

Clipping not shaving intervention guidelines

Preparation for surgery traditionally includes the routine removal of body hair from the intended surgical wound site. Hair is removed because its presence can interfere with the exposure of the incision site, the subsequent wound, suturing of the incision and the application of adhesive drapes and wound dressings (Best Practice 2007).

Studies show that pre-operative hair removal by any means is associated with increased SSI rates (Mangram et al 1999). Hair should not be removed unless it interferes with the operation (WHO 2016, Canadian Patient Safety Institute 2011, National Institute for Health and Care Excellence 2008). If removal is necessary, remove by clipping not shaving (Nichols 2001).

Clipping rather than shaving improves the safety and quality of patient care. Hair removal should be performed outside the operating room using hospital-approved electric clippers as close to the time of the procedure as possible.

Inappropriate hair removal

Much of the focus of SSI prevention research in relation to hair removal has been on removal practices in hospitals by surgical and nursing teams. Studies have shown that:

- pre-operative hair removal the night before an operation is associated with a significantly higher risk of SSI than hair removal immediately before the operation. This is due to skin micro-trauma and bacterial colonisation (Ng et al 2013)
- hair removal with a razor causes epidermal micro-trauma and bacterial colonisation and is associated with a higher risk of SSI, therefore should not be used (Ng et al 2013).

Update your policies and procedures

Ensure your policies and procedures about pre-operative hair removal are up to date and include the following:

- If hair removal is necessary, use clippers to prepare the surgical site pre-operatively.
- Use either a single use electric or battery-powered clipper. Clippers should be disinfected as per the manufacturer's instructions.
- To limit bacterial contamination of the surgical site, clipping should occur less than two hours before surgery.
- Hair removal should occur outside the operating theatre or procedure room, but inside the operating department. Clipping the hair outside of the operating room minimises the dispersal of loose hair and therefore the potential for contamination of the sterile field and/or the surgical wound.
- Remove razors from surgical wards and operating rooms to prevent their use for hair removal.

Patient education

Engaging patients in their care is important – educate them about appropriate hair removal in pre-operative patient literature.

You can help to educate patients about not shaving in the vicinity of the surgical site before their surgery by incorporating this message into pre-operative patient information (AORN 2013) and conversations.

10 References and bibliography | Ngā tohutoro me te rārangi pukapuka

AORN. 2013. Perioperative Standards and Recommended Practices. Denver, CO: *AORN* 1: 75–90.

APIC. 2010. *Guide to the elimination of orthopaedic surgical site infections.* URL: https://apic.org/Resource_/EliminationGuideForm/34e03612-d1e6-4214-a76b-e532c6fc3898/File/APIC-Ortho-Guide.pdf (retrieved September 2018).

Bratzler DW, Dellinger EP, Olsen KM. 2013. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Surgical Infections* 14: 1. http://doi.org/10.1089/sur.2013.9999

Canadian Patient Safety Institute. 2014. *Prevent Surgical Site Infections, Get Started Kit.* Canadian Patient Safety Institute. URL: www.patientsafetyinstitute.ca/en/toolsresources/pages/ssi-resources-getting-started-kit.aspx (retrieved September 2018).

Centers for Disease Control and Prevention. 2018a. Procedure-associated Module SSI. URL: www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf?agree=yes&next=Accept (retrieved May 2018).

Centers for Disease Control and Prevention. 2018b. *CDC/NHSN surveillance definitions for specific types of infections.* URL: www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf.

Centers for Disease Control and Prevention. nd. Surgical Site Infection (SSI). URL: www.cdc.gov/hai/ssi/ssi.html.

Classens DC, Evans RS, Pestotnik SL, et al. 1992. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *New England Journal Medicine* 326: 281–6.

Edmiston CE, Krepel C, Kelly H, et al. 2004. Perioperative antibiotic prophylaxis in gastric bypass patient: do we achieve therapeutic levels? *Surgery* 136: 738–47.

Forse RA, Karam B, MacLean LD, et al. 1989. Antibiotic prophylaxis for surgery in morbidly obese patients. *Surgery* 106: 750–7.

Graves N, Nichols T, Morris A. 2003a. Modelling the costs of hospital-acquired infections in New Zealand. *Infection Control and Hospital Epidemiology* 24: 214–23.

Graves N, Nicholls TM, Morris AJ, et al. 2003b. The prevalence and estimates of the cumulative incidence of hospital-acquired infections among patients admitted to Auckland District Health Board hospitals in New Zealand. *Infection Control and Hospital Epidemiology* 24: 56–61.

Haley R, Culver D, White J, et al. 1985. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *American Journal Epidemiology* 121: 182–205.

Haley V, Van Antwerpen C, Boldstetseg T, et al. 2012. Use of administrative data in efficient auditing of hospital acquired surgical site infections, New York State 2009–2010. *Infection Control Hospital Epidemiology* 33: 565–71.

Health Protection Agency. 2008. *Protocol for the Surveillance of Surgical Site Infection* (version 4). London: Health Protection Agency.

Health Protection Scotland. 2011. *Surveillance of Surgical Site Infections: LIGHT Protocol v1.0*. NHS Scotland.

Ho VP, Nicolau DP, Dakin GF, et al. 2012. Cefazolin dosing for surgical prophylaxis in morbidly obese patient. *Surgical Infections* 13: 33–7.

Institute for Healthcare Improvement. 2012. *A how to guide: Prevent surgical site infection for hip and knee arthroplasty.* Boston, MA: Institute for Healthcare Improvement. URL: www.ihi.org/knowledge/Pages/Tools/HowtoGuidePreventSSIforHipKneeArthroplasty.aspx (retrieved September 2018).

Joanna Briggs Institute. 2007. Pre-operative hair removal to reduce surgical site infection. *Best Practice* 11: 1–4.

Koopman E, Nix DE, Erstad BL, et al. 2007. End-of-procedure cefazolin concentrations after administration for prevention of surgical-site infection. *American Journal Health-System Pharmacy* 64: 1927–34.

Magill S, Hellinger W, Cohen J, et al. 2012. Prevalence of healthcare-associated infections in acute care hospitals in Jacksonville, Florida. *Infection Control and Hospital Epidemiology* 33: 283–90.

Maiwald M, Chan E. 2012. The Forgotten Role of Alcohol: A Systematic Review and Meta-Analysis of the Clinical Efficacy and Perceived Role of Chlorhexidine in Skin Antisepsis. *PLoS One* 7: e44277.

Mangram A, Horan T, Pearson M, et al. 1999. Guideline for Prevention of Surgical Site Infection, Centers for Disease Control and Prevention, Hospital Infection Control Practices Advisory Committee. *Infection Control & Hospital Epidemiology* 20(4): 247–80. doi:10.1086/501620. URL: https://www.ncbi.nlm.nih.gov/pubmed/10196487.

Mannien J, Van der Zeeuw A, Wille J, et al. 2007. Validation of surgical site. infection surveillance in the Netherlands. *Infection Control Hospital Epidemiology* 28: 36–41.

National Institute for Health and Care Excellence. 2008. *Clinical Guideline: October 2008. Surgical Site Infection – Prevention & treatment of surgical site infection*. London: National Institute for Health and Clinical Excellence. (updated in Feb 2017) URL: www.nice.org.uk/guidance/cg74.

National Quality Improvement Programme (NQIP). 2010. *Recommendations for a National Surgical and Procedural Site Infection Surveillance Programme*. Wellington: NQIP.

New Zealand Health and Disability Standard (Infection Prevention and Control) 8134.3:2008.

Ng W, Alexander D, Kerr B, et al. 2013. A hairy tale: successful patient education strategies to reduce pre-hospital hair removal by patients undergoing elective caesarean section. *Journal of Hospital Infection* 83: 64–7.

NHS Wales. 2010. *How to guide: reducing surgical complications.* URL: www.1000livesplus.wales.nhs.uk/sitesplus/documents/1011/Reducing%20Surgical%20ComplicationsWHOFinaldraft%20v2%201.pdf.

Nichols RL. 2001. Preventing surgical site infections: a surgeon's perspective. *Emerg Infect Dis* 7(2): 220–4. URL: https://www.ncbi.nlm.nih.gov/pubmed/11294711.

Nicholls T, Morris AJ. 1997. Nosocomial Infection in Auckland Healthcare Hospitals. *New Zealand Medical Journal* 110: 314–6.

Office of the Auditor-General. 2003. *The management of hospital-acquired infection.* Wellington: Office of the Auditor-General. www.oag.govt.nz/2003/hospital-infections/docs/hospital-vol-1.pdf (retrieved 17 October 2012).

Roy M. 2003. *Modern Approaches to Preventing Surgical Site Infections*. In: Wenzel ER. *Prevention and control of nosocomial infections* (4th edition). Lippincott: Williams & Wilkins. pp 269–84

Safety and Quality Investment for Reform (SQuIRe), Western Australia, Australia. 2007. *CPI Guide, Surgical Site Infection Prevention.* www.safetyandquality.health.wa.gov.au/squire/ URL: http://healthywa.wa.gov.au/~/media/Files/Corporate/general%20documents/Quality/PDF/SQuIReHandbook.ashx.

The Joint Commission. 2013. *The Joint Commission's Implementation Guide for NPSG.07.05.01 on Surgical Site Infections: The SSI Change Project.* The Joint Commission. URL: www.jointcommission.org/assets/1/18/Implementation_Guide_for_NPSG_SSI.pdf (retrieved September 2018).

van Kralingen S, Taks M, Diepstraten J, et al. 2011. Pharmacokinetics and protein binding of cefazolin in morbidly obese patients. *European Journal of Clinical Pharmacology* 67: 985–92.

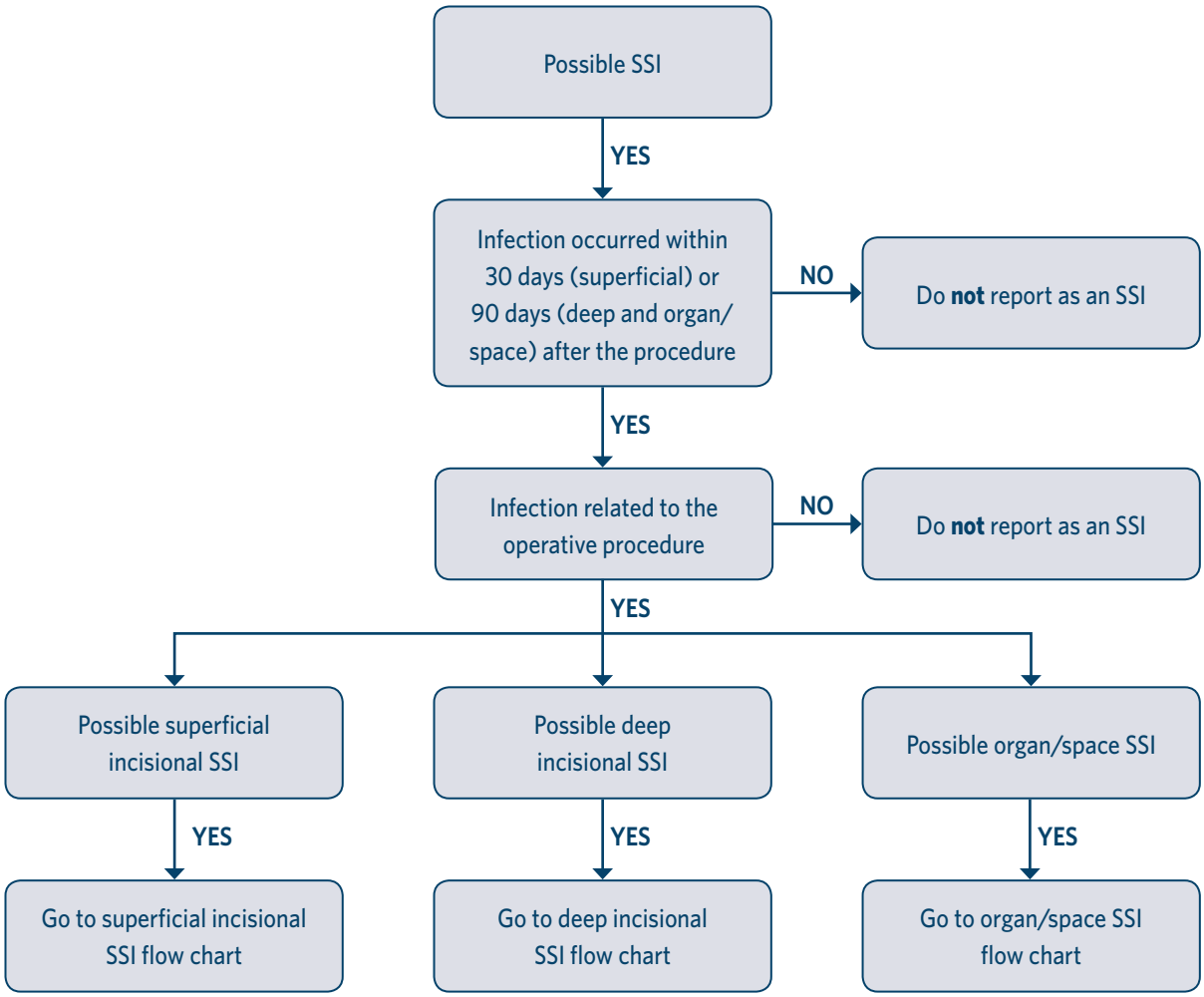
WHO: Patient Safety. 2016. *WHO Global guidelines on the prevention of surgical site infection.* Geneva: WHO.

11 Appendices | Ngā āpitihanga

Appendix 1: Flow charts to assist decision-making

The following flow charts are based on National Healthcare Safety Network definitions but have been adapted from the Welsh Healthcare Associated Infection SSI Surveillance Diagnostic Tool (Version 1, 2007).[3]

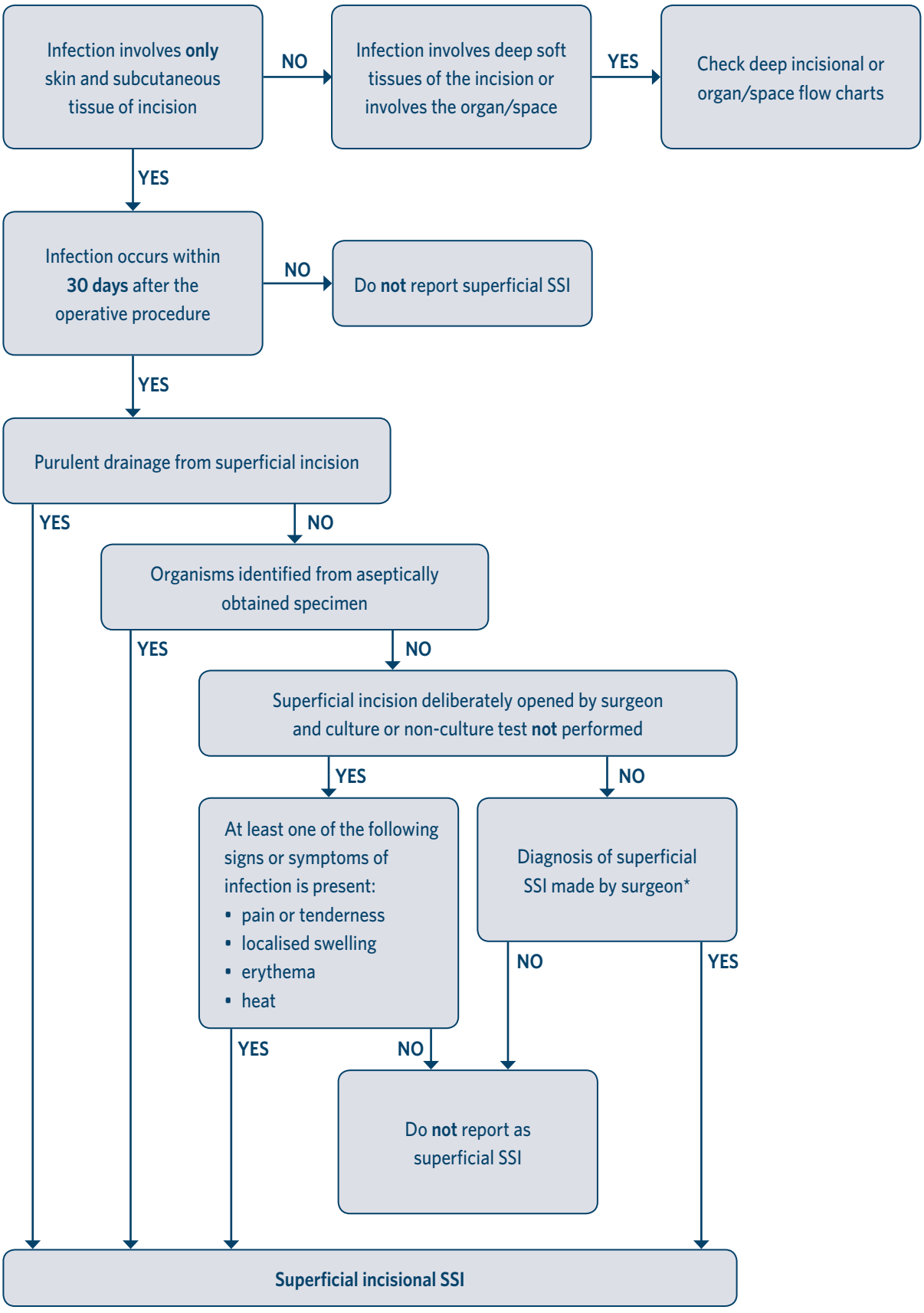
Possible SSI flow chart



3 See: www2.nphs.wales.nhs.uk:8080/WHAIPDocs.nsf/3dc04669c9e1eaa880257062003b246b/8bc137906e1d768e8025765e003e9f94/$FILE/Orthopaedic%20SSI%20Diagnostic%20Tool.pdf.

Possible superficial incisional SSI flow chart

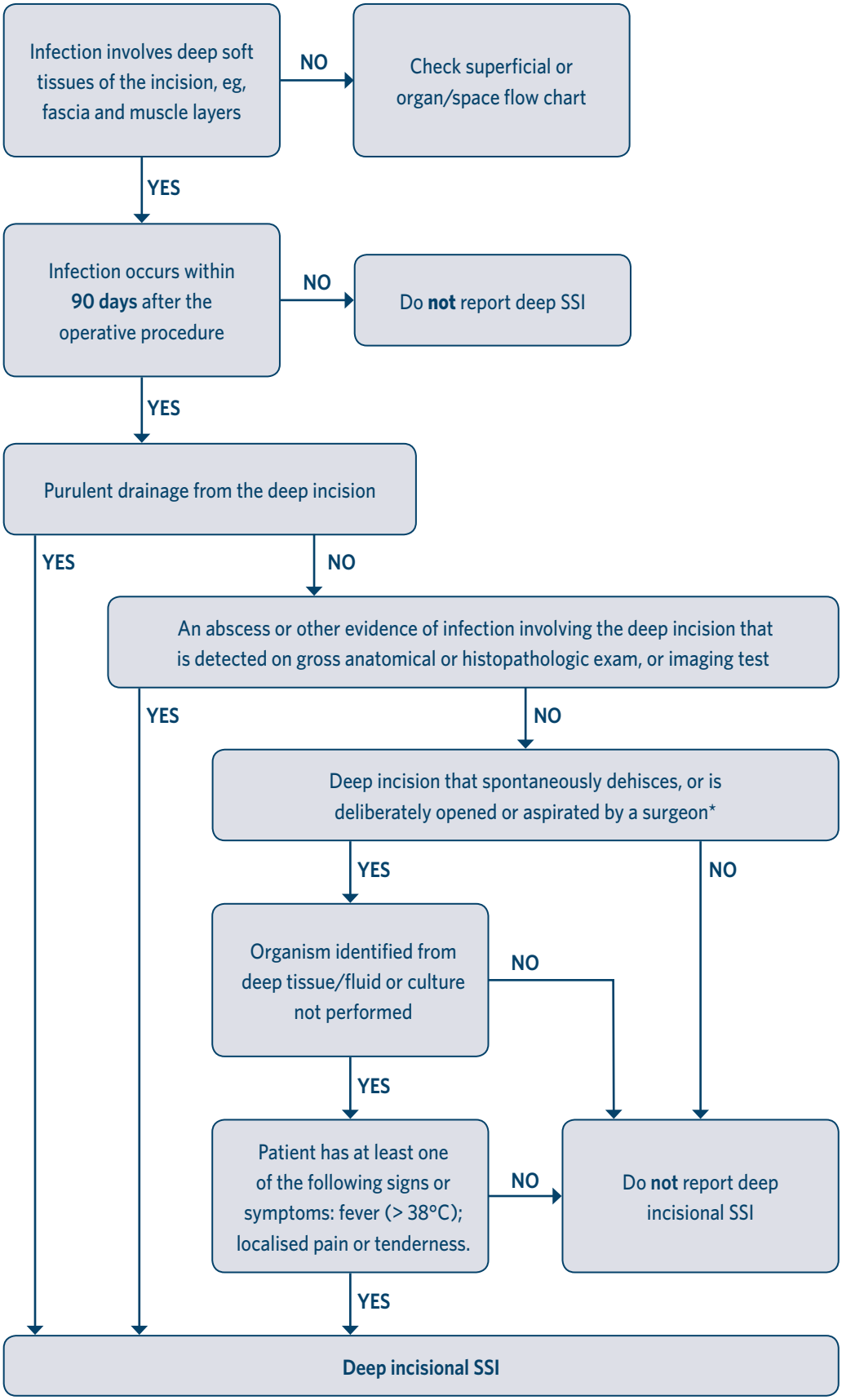
(Occurs within 30 days after the procedure. Day 1 = procedure date)



** Also includes other medical practitioners on the case, or their designee (nurse practitioner or physician's assistant).*

Possible deep incisional SSI flow chart

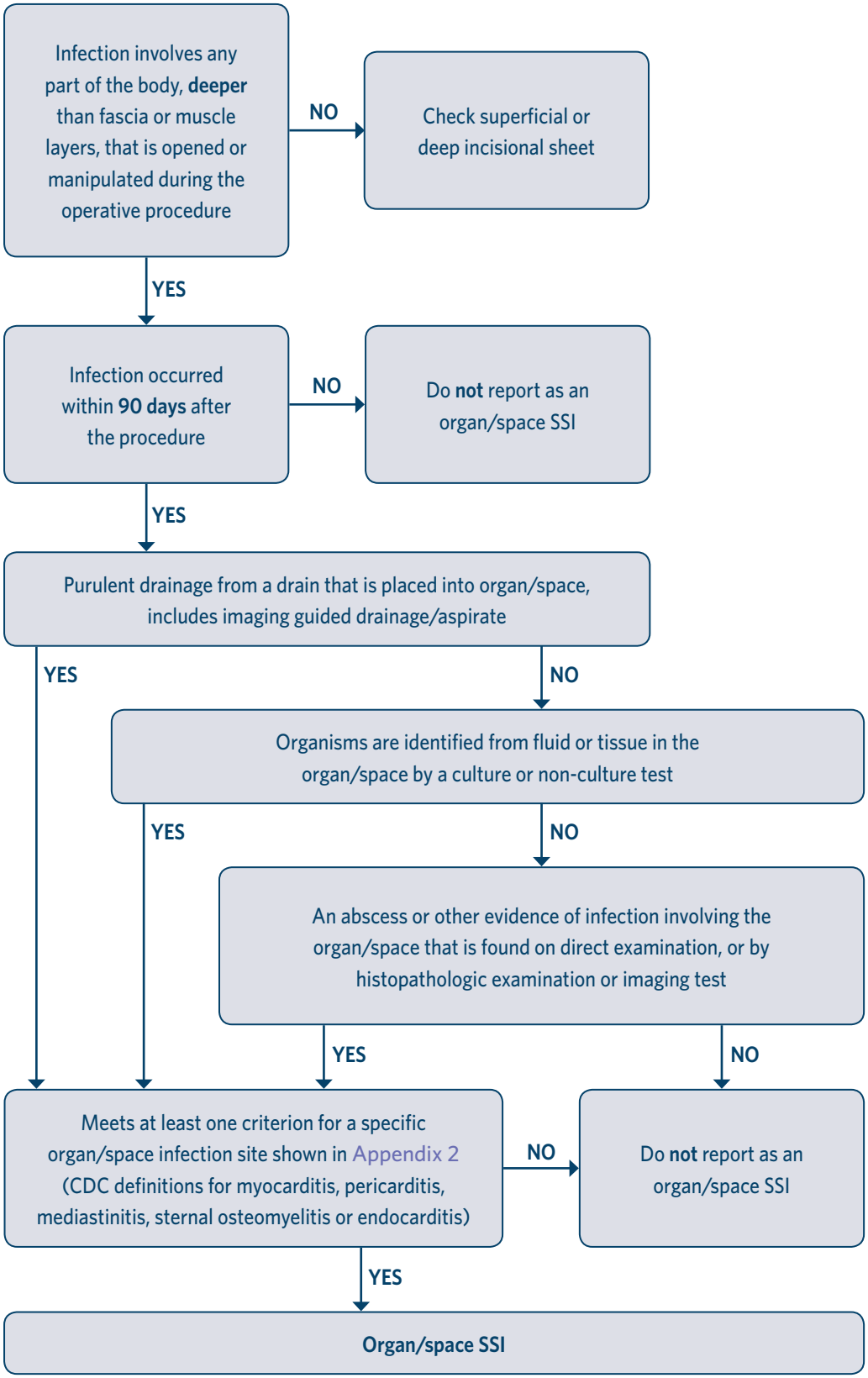
(Occurs within 90 days after the procedure. Day 1 = procedure date)



** Also includes other medical practitioners on the case, or their designee (nurse practitioner or physician's assistant).*

Possible organ/space SSI

(Infection occurred within 90 days after the procedure. Day 1 = procedure date)



Appendix 2: CDC/NHSN surveillance definitions for specific types of infections

See: www.cdc.gov/nhsn/pdfs/pscmanual/17pscnosinfdef_current.pdf

Cardiovascular system infection

Myocarditis or pericarditis

Myocarditis or pericarditis must meet at least one of the following criteria:

1 Patient has organism(s) identified from pericardial tissue or fluid by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST).

2 Patient has at least ***two*** of the following signs or symptoms: fever (> 38.0°C), chest pain,* paradoxical pulse* or increased heart size.*

And at least ***one*** of the following:

a abnormal EKG consistent with myocarditis or pericarditis

b evidence of myocarditis or pericarditis on histologic exam of heart tissue

c 4-fold rise in paired sera from IgG antibody titer

d pericardial effusion identified by echocardiogram, CT scan, MRI, or angiography.

3 Patient ≤ 1 year of age has at least ***two*** of the following signs or symptoms: fever (> 38.0°C), hypothermia (< 36.0°C), apnea,* bradycardia,* paradoxical pulse* or increased heart size.*

And at least ***one*** of the following:

a abnormal EKG consistent with myocarditis or pericarditis

b histologic examination of heart tissue shows evidence of myocarditis or pericarditis.

c 4-fold rise in paired sera from IgG antibody titer

d pericardial effusion identified by echocardiogram, CT scan, MRI, or angiography.

** With no other recognised cause*

Comment:

Most cases of post-cardiac surgery or post-myocardial infarction pericarditis are not infectious.

Endocarditis

When meeting the endocarditis definition:

- The endocarditis infection window period is defined as the 21 days during which all site-specific infection criteria must be met. It includes the date the first positive diagnostic test that is used as an element of the endocarditis criterion was obtained, the 10 calendar days before and the 10 calendar days after. The infection window period is lengthened for this event to accommodate the **extended** diagnostic timeframe that is frequently required to reach a clinical determination of endocarditis.

- The repeat infection time for endocarditis is extended to include the remainder of the patient's current admission.
- When meeting the endocarditis definition, the secondary BSI attribution period includes the 21-day infection window period **and all subsequent days of the patient's current admission**.
  - As a result of this lengthy secondary BSI attribution period, secondary BSI pathogen assignment for endocarditis, is limited to organism(s) identified in blood specimen that match the organism(s) used to meet the endocarditis definition.
    Example: If the endocarditis definition was met using a site-specific specimen (for example, cardiac vegetation) or using a blood specimen with *S. aureus* as the identified organism, if a blood specimen collected during the endocarditis secondary BSI attribution period is positive for *S. aureus* and *E. coli*, while the *S. aureus* can be assigned to the endocarditis event, it cannot be assumed the *E. coli* can be assigned as a secondary BSI pathogen. The blood organism (*E. coli*) does not match the organism (*S. aureus*) used to meet the endocarditis definition. If the blood specimen can be used to meet an endocarditis definition criterion both organisms can be assigned. Otherwise the *E. coli* will need to be investigated as a separate BSI and identified as a secondary BSI to another site-specific infection or determined to be a primary BSI.

Endocarditis of a natural or prosthetic heart valve must meet at least one of the following criteria:

1 Organism(s) identified from cardiac vegetation,* embolised vegetation (for example, solid-organ abscess) documented as originating from cardiac source, or intracardiac abscess by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST).

2 Organism(s) seen on histopathologic examination of cardiac vegetation, embolised vegetation, for example, solid organ abscess, documented as originating from cardiac source, or intracardiac abscess.

3 Endocarditis seen on histopathologic examination of cardiac vegetation or intracardiac abscess.

4 At least one of the following echocardiographic evidence of endocarditis:*†

   a vegetation on cardiac valve or supporting structures

   b intracardiac abscess

   c new partial dehiscence of prosthetic valve.

   And at least *one* of the following:

   a typical infectious endocarditis organism(s) (specifically, Viridans group streptococci, *Streptococcus bovis*, *Haemophilus* spp, *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Kingella* spp, *S. aureus*, *Enterococcus* spp) identified from ≥ 2 blood collections drawn on separate occasions with no more than one calendar day between specimens by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST)

b *Coxiella burnetii* identified from blood by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST) or identified by anti-phase I IgG antibody titer > 1:800.

5 At least ***three*** of the following:

a prior endocarditis, prosthetic valve, uncorrected congenital heart disease, history of rheumatic heart disease, hypertrophic obstructive cardiomyopathy, or known IV drug use

b fever (> 38.0°C) vascular phenomena: major arterial emboli (specifically, embolic stroke, renal infarct, splenic infarct or abscess, digital ischemic/gangrene from embolic source), septic pulmonary infarcts, mycotic aneurysm (documented by imaging, seen in surgery, or described in gross pathological specimen), intracranial haemorrhage, conjunctival haemorrhages, or Janeway's lesions documented

c immunologic phenomena: glomuleronephritis (documented or chart, or white cell or red blood cell casts on urinalysis), Osler's nodes, Roth's spots, or positive rheumatoid factor.

And at least *one* of the following:

a typical infectious endocarditis organism(s) (specifically, Viridans group streptococci, *Streptococcus bovis*, *Haemophilus* spp, *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis, Eikenella corrodens, Kingella* spp, *S. aureus*, *Enterococcus* spp) identified from ≥ 2 blood collections drawn on separate occasions with no more than one calendar day between specimens by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST)

b *Coxiella burnetii* identified from blood by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment,for example, not active surveillance culture/testing (ASC/AST)or identified by anti-phase I IgG antibody titer > 1:800.

6 At least ***one*** of the following:*†

a vegetation on cardiac valve or supporting structures seen on echocardiogram

b intracardiac abscess seen on echocardiogram

c new partial dehiscence of prosthetic valve seen on echocardiogram.

And at least *three* of the following:

a prior endocarditis, prosthetic valve, uncorrected congenital heart disease, history of rheumatic heart disease, hypertrophic obstructive cardiomyopathy, or known IV drug use

b fever (> 38.0°C)

c vascular phenomena: major arterial emboli (specifically, embolic stroke, renal infarct, splenic infarct or abscess, digital ischemic/gangrene from embolic source), septic pulmonary infarcts, mycotic aneurysm (documented by imaging, seen in surgery, or described in gross pathological specimen), intracranial haemorrhage, conjunctival haemorrhages, or Janeway's lesions documented

d immunologic phenomena: glomuleronephritis (documented in chart, or white cell or red blood cell casts on urinalysis), Osler's nodes, Roth's spots, or positive rheumatoid factor

e identification of organism(s) from the blood by at least one of the following methods:

- recognised pathogen(s) identified from blood by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST)
- same common commensal organism(s) identified from ≥ 2 blood collections drawn on separate occasions on the same or consecutive days by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST).

7 All of the following criteria:

a prior endocarditis, prosthetic valve, uncorrected congenital heart disease, history of rheumatic heart disease, hypertrophic obstructive cardiomyopathy, or known IV drug use

b fever (> 38.0°C)

c vascular phenomena: major arterial emboli (specifically, embolic stroke, renal infarct, splenic infarct or abscess, digital ischemic/gangrene from embolic source), septic pulmonary infarcts, mycotic aneurysm (documented by imaging, seen in surgery, or described in gross pathological specimen), intracranial haemorrhage, conjunctival haemorrhages, or Janeway's lesions documented

d immunologic phenomena: glomuleronephritis (documented or chart, or white cell or red blood cell casts on urinalysis), Osler's nodes, Roth's spots, or positive rheumatoid factor

e identification of organism(s) from the blood by at least one of the following methods:

- recognised pathogen(s) identified from blood by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST).
- same common commensal organism(s) identified from ≥ 2 blood collections drawn on separate occasions on the same or consecutive days by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST).

** 'Cardiac vegetation' includes vegetation on a pacemaker/defibrillator lead or ventricular assist devices (VAD) components within the heart.*

† Which if equivocal is supported by clinical correlation (specifically, physician documentation of antimicrobial treatment for endocarditis).

Mediastinitis

Mediastinitis must meet at least **one** of the following criteria:

1 Patient has organism(s) identified from mediastinal tissue or fluid by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not active surveillance culture/testing (ASC/AST).

2 Patient has evidence of mediastinitis on gross anatomic or histopathologic exam.

3 Patient has at least one of the following signs or symptoms: fever (> 38.0°C), chest pain* or sternal instability.*

   And at least ***one*** of the following:

   a purulent drainage from mediastinal area

   b mediastinal widening on imaging test.

4 Patient ≤ 1 year of age has at least ***one*** of the following signs or symptoms: fever (> 38.0°C), hypothermia (< 36.0°C), apnea,* bradycardia* or sternal instability.*

   And at least ***one*** of the following:

   a purulent drainage from mediastinal area

   b mediastinal widening on imaging test.

** With no other recognised cause*

Comment:

The mediastinal space is the area under the sternum and in front of the vertebral column, containing the heart and its large vessels, trachea, esophagus, thymus, lymph nodes, and other structures and tissues. It is divided into anterior, middle, posterior, and superior regions.

Appendix 3: Complete list of ACHI codes of procedures for inclusion

Legacy code	ACHI code	Procedure description
CARD	3350900	Aorta endarterectomy
CARD	3828703	Open ablation of arrhythmia circuit or focus, not elsewhere classified
CARD	3828704	Open ablation of arrhythmia circuit or focus involving left atrial chamber
CARD	3829002	Open ablation of arrhythmia circuit or focus involving both atrial chambers
CARD	3830001	Open transluminal balloon angioplasty of 1 coronary artery
CARD	3830301	Open transluminal balloon angioplasty of ≥ 2 coronary arteries
CARD	3830603	Open insertion of 1 transluminal stent into single coronary artery
CARD	3830604	Open insertion of ≥ 2 transluminal stents into single coronary artery
CARD	3830605	Open insertion of ≥ 2 transluminal stents into multiple coronary arteries
CARD	3844700	Pericardiectomy, subtotal or complete
CARD	3845600	Other intrathoracic procedures on heart without cardiopulmonary bypass
CARD	3845601	Open valvotomy of pulmonary valve
CARD	3845605	Excision of lesion of pericardium
CARD	3845610	Open valvotomy of aortic valve
CARD	3845611	Open valvotomy of tricuspid valve
CARD	3845612	Other intrathoracic procedures on septum without cardiopulmonary bypass
CARD	3845613	Other intrathoracic procedures on atrium without cardiopulmonary bypass
CARD	3845614	Other intrathoracic procedures on ventricle of heart without cardiopulmonary bypass
CARD	3845615	Other intrathoracic procedures on aortic valve without cardiopulmonary bypass
CARD	3845616	Other intrathoracic procedures on mitral valve without cardiopulmonary bypass
CARD	3845617	Other intrathoracic procedures on tricuspid valve without cardiopulmonary bypass
CARD	3845618	Other intrathoracic procedures on pulmonary valve without cardiopulmonary bypass
CARD	3845619	Other intrathoracic procedures on arteries of heart without cardiopulmonary bypass
CARD	3847500	Mitral valve annuloplasty
CARD	3847501	Tricuspid valve annuloplasty
CARD	3847502	Aortic valve annuloplasty

Legacy code	ACHI code	Procedure description
CARD	3847700	Mitral valve annuloplasty with ring insertion
CARD	3847701	Tricuspid valve annuloplasty with ring insertion
CARD	3847702	Aortic valve annuloplasty with ring insertion
CARD	3848000	Repair of aortic valve, 1 leaflet
CARD	3848001	Repair of mitral valve, 1 leaflet
CARD	3848002	Repair of tricuspid valve, 1 leaflet
CARD	3848100	Repair of aortic valve, 2 or more leaflets
CARD	3848101	Repair of mitral valve, ≥ 2 leaflets.
CARD	3848102	Repair of tricuspid valve, ≥ 2 leaflets
CARD	3848300	Decalcification of aortic valve leaflet
CARD	3848500	Reconstruction of mitral valve annulus
CARD	3848501	Decalcification of mitral valve
CARD	3848700	Open valvotomy of mitral valve
CARD	3848800	Replacement of aortic valve with mechanical prosthesis
CARD	3848801	Replacement of aortic valve with bioprosthesis
CARD	3848802	Replacement of mitral valve with mechanical prosthesis
CARD	3848803	Replacement of mitral valve with bioprosthesis
CARD	3848804	Replacement of tricuspid valve with mechanical prosthesis
CARD	3848805	Replacement of tricuspid valve with bioprosthesis
CARD	3848806	Replacement of pulmonary valve with mechanical prosthesis
CARD	3848807	Replacement of pulmonary valve with bioprosthesis
CARD	3848900	Replacement of aortic valve with homograft
CARD	3848901	Replacement of aortic valve with unstented heterograft
CARD	3848902	Replacement of mitral valve with homograft
CARD	3848903	Replacement of tricuspid valve with homograft
CARD	3848904	Replacement of pulmonary valve with homograft
CARD	3848905	Replacement of pulmonary valve with unstented heterograft
CARD	3849000	Reconstruction and reimplantation of subvalvular structures
CARD	3849300	Operative management of acute infective endocarditis during heart valve procedure
CARD	3850500	Open coronary endarterectomy
CARD	3850700	Left ventricular aneurysmectomy
CARD	3850800	Left ventricular aneurysmectomy with patch graft
CARD	3850900	Repair of ventricular septal rupture
CARD	3851200	Division of accessory pathway involving 1 atrial chamber

Legacy code	ACHI code	Procedure description
CARD	3851500	Division of accessory pathways involving both atrial chambers
CARD	3851800	Ventricular muscle ablation
CARD	3855000	Repair of ascending thoracic aorta
CARD	3855001	Replacement of ascending thoracic aorta
CARD	3855300	Repair of ascending thoracic aorta with aortic valve repair
CARD	3855301	Repair of ascending thoracic aorta with aortic valve replacement
CARD	3855302	Replacement of ascending thoracic aorta with aortic valve repair
CARD	3855303	Replacement of ascending thoracic aorta with aortic valve replacement
CARD	3855600	Repair of ascending thoracic aorta with aortic valve repair and implantation of coronary arteries
CARD	3855601	Repair of ascending thoracic aorta with aortic valve replacement and implantation of coronary arteries
CARD	3855602	Replacement of ascending thoracic aorta with aortic valve repair and implantation of coronary arteries
CARD	3855603	Replacement of ascending thoracic aorta with aortic valve replacement and implantation of coronary arteries
CARD	3855900	Repair of aortic arch and ascending thoracic aorta
CARD	3855901	Replacement of aortic arch and ascending thoracic aorta
CARD	3856200	Repair of aortic arch and ascending thoracic aorta with aortic valve repair
CARD	3856201	Repair of aortic arch and ascending thoracic aorta with aortic valve replacement
CARD	3856202	Replacement of aortic arch and ascending thoracic aorta with aortic valve repair
CARD	3856203	Replacement of aortic arch and ascending thoracic aorta with aortic valve replacement
CARD	3856500	Repair of aortic arch and ascending thoracic aorta with aortic valve repair and implantation of coronary arteries
CARD	3856501	Repair of aortic arch and ascending thoracic aorta with aortic valve replacement and implantation of coronary arteries
CARD	3856502	Replacement of aortic arch and ascending thoracic aorta with aortic valve repair and implantation of coronary arteries
CARD	3856503	Replacement of aortic arch and ascending thoracic aorta with aortic valve replacement and implantation of coronary arteries
CARD	3856800	Repair of descending thoracic aorta
CARD	3856801	Replacement of descending thoracic aorta
CARD	3857100	Repair of descending thoracic aorta with shunt
CARD	3857101	Replacement of descending thoracic aorta with shunt

Legacy code	ACHI code	Procedure description
CARD	3857200	Operative management of acute rupture or dissection of thoracic aorta
CARD	3863700	Reoperation for reconstruction of coronary artery graft
CARD	3864700	Division of thoracic adhesions
CARD	3865000	Cardiac myotomy
CARD	3865001	Cardiac myectomy
CARD	3865002	Open chest transmyocardial revascularisation
CARD	3865003	Other transmyocardial revascularisation
CARD	3865300	Other intrathoracic procedures on heart with cardiopulmonary bypass
CARD	3865301	Other intrathoracic procedures on atrium with cardiopulmonary bypass
CARD	3865302	Other intrathoracic procedures on ventricle of heart with cardiopulmonary bypass
CARD	3865303	Other intrathoracic procedures on septum with cardiopulmonary bypass
CARD	3865304	Other intrathoracic procedures on aortic valve with cardiopulmonary bypass
CARD	3865305	Other intrathoracic procedures on mitral valve with cardiopulmonary bypass
CARD	3865306	Other intrathoracic procedures on tricuspid valve with cardiopulmonary bypass
CARD	3865307	Other intrathoracic procedures on pulmonary valve with cardiopulmonary bypass
CARD	3865308	Other intrathoracic procedures on arteries of heart with cardiopulmonary bypass
CARD	3867000	Excision of lesion of atrial wall or interatrial septum
CARD	3867300	Excision of lesion of atrial wall or interatrial septum with reconstruction by patch graft
CARD	3867301	Excision of lesion of atrial wall or interatrial septum with reconstruction by conduit
CARD	3867700	Partial thickness excision of lesion of ventricular myocardium
CARD	3868000	Full thickness excision of lesion of ventricular myocardium with repair or reconstruction
CARD	3870001	Closure of patent ductus arteriosus
CARD	3870003	Closure of cardiac collateral vessel
CARD	3870600	Repair of aorta
CARD	3870601	Repair of aorta with anastomosis
CARD	3871200	Repair of aortic interruption
CARD	3871500	Banding of main pulmonary artery
CARD	3871501	Debanding of main pulmonary artery

Legacy code	ACHI code	Procedure description
CARD	3871502	Other repair of main pulmonary artery
CARD	3872700	Repair of intrathoracic vessels
CARD	3872701	Repair of intrathoracic vessels with anastomosis
CARD	3873300	Creation of systemic pulmonary shunt
CARD	3873900	Atrial septectomy or septostomy
CARD	3874202	Closure of atrial septal defect
CARD	3874500	Intra-atrial transposition of venous return
CARD	3874800	Ventricular septectomy
CARD	3875102	Closure of ventricular septal defect
CARD	3875400	Intraventricular baffle procedure
CARD	3875401	Creation of intraventricular conduit
CARD	3875700	Creation of extracardiac conduit between right ventricle and pulmonary artery
CARD	3875701	Creation of extracardiac conduit between left ventricle and aorta
CARD	3875702	Creation of extracardiac conduit between atrium and pulmonary artery
CARD	3876000	Replacement of extracardiac conduit between right ventricle and pulmonary artery
CARD	3876001	Replacement of extracardiac conduit between left ventricle and aorta
CARD	3876002	Replacement of extracardiac conduit between atrium and pulmonary artery
CARD	3876300	Left ventricular myectomy
CARD	3876301	Right ventricular myectomy
CARD	3876600	Left ventricular augmentation
CARD	3876601	Right ventricular augmentation
CARD	4390900	Aortopexy
CARD	9020500	Heart transplantation
CARD	9020501	Heart and lung transplantation
CARD	9020600	Cardiomyoplasty
CARD	9022400	Repair of transposition of great vessels
CBGB	3849700	Coronary artery bypass, using 1 saphenous vein graft
CBGB	3849701	Coronary artery bypass, using 2 saphenous vein grafts
CBGB	3849702	Coronary artery bypass, using 3 saphenous vein grafts
CBGB	3849703	Coronary artery bypass, using ≥ 4 saphenous vein grafts
CBGB	3849704	Coronary artery bypass, using 1 other venous graft
CBGB	3849705	Coronary artery bypass, using 2 other venous grafts

Legacy code	ACHI code	Procedure description
CBGB	3849706	Coronary artery bypass, using 3 other venous grafts
CBGB	3849707	Coronary artery bypass, using ≥ 4 other venous grafts
CBGB	3850002	Coronary artery bypass, using 1 radial artery graft
CBGB	3850004	Coronary artery bypass, using 1 other arterial graft
CBGB	3850302	Coronary artery bypass, using ≥ 2 radial artery grafts
CBGB	3850304	Coronary artery bypass, using ≥ 2 other arterial grafts
CBGB	9020100	Coronary artery bypass, using 1 other graft, not elsewhere classified
CBGB	9020101	Coronary artery bypass, using 2 other grafts, not elsewhere classified
CBGB	9020102	Coronary artery bypass, using 3 other grafts, not elsewhere classified
CBGB	9020103	Coronary artery bypass, using ≥ 4 other grafts, not elsewhere classified
CBGB	3850005	Coronary artery bypass, using 1 composite graft
CBGB	3850305	Coronary artery bypass, using ≥ 2 composite grafts
CBGC	3850000	Coronary artery bypass, using 1 LIMA graft
CBGC	3850001	Coronary artery bypass, using 1 RIMA graft
CBGC	3850003	Coronary artery bypass, using 1 epigastric artery graft
CBGC	3850300	Coronary artery bypass, using ≥ 2 LIMA grafts
CBGC	3850301	Coronary artery bypass, using ≥ 2 RIMA grafts
CBGC	3850303	Coronary artery bypass, using ≥ 2 epigastric artery grafts

Appendix 4: Total surgical risk score

This will be calculated as follows providing that the following fields on the data set are completed:

Field	Score = 0 if:	Score = 1 if:
Wound class	1 or 2 (clean/clean-contaminated)	3 or 4 (contaminated or dirty/infected)
ASA classification	1 or 2	3, 4 or 5
Duration of operation	≤ 4 hours CBGC ≤ 5 hours CBGB ≤ 5 hours CARD	> 4 hours CBGC > 5 hours CBGB > 5 hours CARD
Total surgical risk index =	Sum of scores	

DHB data collectors do not need to calculate the total surgical risk index. This will be calculated during data analysis and used to risk stratify procedures in the report.

Appendix 5: Data collection form

Cardiac Data Collection Form

Last Update November 2018

SSII Surgical Site Infection Improvement Programme

Patient Information (Denominator Data)				
Form ID				Insert patient sticker here if available. However, the only mandatory information required for data entry is specified in the adjacent table.
Facility ID				
NHI				
Gender	M ☐	F ☐	Unknown ☐	
Date of Birth	__/__/____.			

Primary Admission/ Discharge	
Date of admission	__/__/____. *Click here to enter a date.*
Date of discharge	__/__/____. *Click here to enter a date.*
Date of death (if applicable)	__/__/____. *Click here to enter a date.*

Procedure					
Date of procedure	__/__/____. *Click here to enter a date.*				
Procedure Category *(Select priority if multiple procedures)*	☐ CARD	☐ CBGB	☐ CBGC		
Procedure description *(Select only one ICD10 code depending on procedure category selected above)*	_____. CARD Procedure Codes *Choose an item.* CBGB Procedure Codes *Choose an item.* CBGC Procedure Codes *Choose an item.*				
Is operation due to infection?	☐ Y	☐ N	☐ Unknown		
Is procedure an emergency?	☐ Y	☐ N	☐ Unknown		
Surgeon grade	☐ Consultant	☐ Specialty Registrar	☐ Locum Consultant	☐ Locum Registrar	☐ Other
Surgeon code					

Risk Score						
Wound class	☐ Clean	☐ Clean-Contaminated	☐ Contaminated	☐ Dirty or infected		
Knife to skin time	_____/_____ 24hr clock					
Wound closure time	_____/_____ 24hr clock					
ASA score	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ Not Recorded

Anaesthetic			
Type of anaesthetic	☐ General	☐ Other	☐ Not Recorded

Pre-operative Information				
Diabetes Mellitus	☐ N	☐ Type I	☐ Type II	☐ Unknown
Smoking	☐ Y	☐ N		☐ Unknown
Hair Removal	☐ Clipping	☐ Shaving	☐ Other	☐ Unknown

Antibiotic Prophylaxis			
If more than one antibiotic administered use Additional Antibiotic/ Microbiology Form.			
Was antibiotic prophylaxis given?	☐ Y	☐ N	☐ Unknown
Antibiotic 1 Name	_____. *Choose an item.*		
Date given	__/__/____ *Click here to enter a date.*		
Time given	_____/_____ 24hr clock		
Dose and Unit	_____. _____ *Choose an item.*		
When was it administered?	_____. *Choose an item.*		

Intra-operative antibiotics				
Additional dose on Bypass?	☐ Y	☐ N	☐ Unknown	☐ N/A
Was an additional dose of antibiotics given intraoperatively e.g. for lengthy procedure?	☐ Y	☐ N	☐ Unknown	

Post-operative antibiotics			
Were antibiotics given post-operatively?	☐ Y	☐ N	☐ Unknown
If yes, were they given for less than 48 hrs	☐ Y	☐ N	☐ Unknown

Skin Preparation Type Used	
☐ Chlorhexidine and alcohol	☐ Aqueous Chlorhexidine
☐ Povidone iodine and alcohol	☐ Other *(Contact SSII Programme team to get added)*
☐ Aqueous povidone iodine	☐ Unknown

Patient BMI				
Height _____ or ☐ Unknown	Weight _____ or ☐ Unknown	BMI _____or ☐ Unknown		
Post-op Information				
Delayed Chest Closure Was Chest Open at End of Procedure?	☐ Y	☐ N	☐ Unknown	
Return to Theatre Another chest procedure during this admission?	☐ Y	☐ N	☐ Unknown	
Glucose Control Post-Op Glucose Control?	☐ Y	☐ N	☐ Unknown	

Pre-operative anti-Staphylococcal bundle					
Did the patient receive anti-Staphylococcal aureus bundle?	☐ No bundle protocol	☐ Y	☐ N	☐ Unknown	
If pre-screening was performed on the patient what was the result? (*Select "MRSA Positive" if mixed result.*)	☐ N/A *(No pre-screening)*	☐ No S.aureus	☐ MSSA Positive	☐ MRSA Positive	☐ Unknown
Skin Decolonisation – compliance	☐ Full *(all doses)*	☐ Partial *(some doses)*	☐ Not *(no doses)*	☐ N/A *(not in bundle)*	☐ Unknown
Nasal Decolonisation – compliance	☐ Full *(all doses)*	☐ Partial *(some doses)*	☐ Not *(no doses)*	☐ N/A *(not in bundle)*	☐ Unknown

Readmission (Numerator Data)	
Has patient been readmitted due to SSI?	☐ Y ☐ N
If yes, date of readmission.	__/__/____. *Click here to enter a date.*
SSI Details (Numerator Data)	
Has SSI criteria been met for this procedure?	☐ Y ☐ N
Infection Site	☐ Chest Only ☐ Donor Only ☐ Both sites
When was SSI diagnosed?	☐ During initial admission ☐ During readmission up to 30 days post procedure ☐ During readmission up to 90 days post procedure
Date of Infection	__/__/____. *Click here to enter a date.*
Type of SSI *(check decision making flow charts)*	☐ Superficial *(must occur within **30 days** post procedure)* *The following SSIs must occur within **90 days** post procedure* ☐ Deep ☐ Organ space – *endocarditis* ☐ Organ/space – *mediastinitis* ☐ Organ space – *pericarditis* ☐ Organ space – *myocarditis* ☐ Organ space – *sternal osteomyelitis*

Microbiology	
If more than one clinical sample taken please use Additional Antibiotic/ Microbiology Form.	
Clinical Sample taken?	☐ Y ☐ N
Site of Sample One	☐ Blood ☐ Tissue ☐ Aspirate ☐ Wound swab ☐ Other
Clinically significant organism?	☐ Y ☐ N
If yes, identify organism.	☐ Acinetobacter baumanii ☐ Candida albicans ☐ Enterococcus faecalis ☐ Enterococcus faecium ☐ Escherichia coli ☐ Klebsiella oxytoca ☐ Klebsiella pneumoniae ☐ Pseudomonas aeruginosa ☐ Serratia marcescens ☐ Staphylococcus aureus ☐ Staphylococcus epidermidis ☐ Streptococcus pyogenes (GpA) ☐ Streptococcus agalactiae (GpB) ☐ Other (please state) ☐ Not specified _____.
Is the organism an MDRO?	☐ Y ☐ N
If yes, which of the following?	☐ MRSA ☐ ESBL ☐ VRE ☐ CRO *includes CRO, CRE, CPE, NDM* ☐ Other
Notes (For your own reference. This is not reviewed by the SSII programme)	

2

SSIIP Data Collection Form
Additional antibiotic/microbiology
Last Update November 2018

SSII Surgical Site Infection Improvement Programme

This form should only be used in conjunction with an SSIIP Data Collection Form when more than one Antibiotic is used and/or more than one microbiology test has been done for a procedure.

Patient Information (Denominator Data)				
Form ID				Insert patient sticker here if available.
Facility ID				
NHI				
Gender	M ☐	F ☐	Unknown ☐	
Date of Birth	__/__/____.			

Antibiotic Prophylaxis	
Antibiotic 2 Name	_____.Choose an item.
Date given	__/__/____ Click here to enter a date.
Time given	____/____ 24hr clock
Dose and Unit	_____ Choose an item.
When was it administered?	_____.Choose an item.
Antibiotic 2 Name	_____.Choose an item.
Date given	__/__/____ Click here to enter a date.
Time given	____/____ 24hr clock
Dose and Unit	_____ Choose an item.
When was it administered?	_____.Choose an item.

Microbiology					
Site of Sample Two	☐ Blood	☐ Tissue	☐ Aspirate	☐ Wound swab	☐ Other
Clinically significant organism?	☐ Y	☐ N			
If yes, identify organism.	☐ Acinetobacter baumanii ☐ Enterococcus faecalis ☐ Escherichia coli ☐ Klebsiella pneumoniae ☐ Serratia marcescens ☐ Staphylococcus epidermidis ☐ Streptococcus agalactiae (GpB) ☐ Not specified _____.		☐ Candida albicans ☐ Enterococcus faecium ☐ Klebsiella oxytoca ☐ Pseudomonas aeruginosa ☐ Staphylococcus aureus ☐ Streptococcus pyogenes (GpA) ☐ Other (please state)		
Is the organism an MDRO?	☐ Y	☐ N			
If yes, which of the following?	☐ MRSA	☐ ESBL	☐ VRE	☐ CRO	☐ Other
Site of Sample Three	☐ Blood	☐ Tissue	☐ Aspirate	☐ Wound swab	☐ Other
Clinically significant organism?	☐ Y	☐ N			
If yes, identify organism.	☐ Acinetobacter baumanii ☐ Enterococcus faecalis ☐ Escherichia coli ☐ Klebsiella pneumoniae ☐ Serratia marcescens ☐ Staphylococcus epidermidis ☐ Streptococcus agalactiae (GpB) ☐ Not specified _____.		☐ Candida albicans ☐ Enterococcus faecium ☐ Klebsiella oxytoca ☐ Pseudomonas aeruginosa ☐ Staphylococcus aureus ☐ Streptococcus pyogenes (GpA) ☐ Other (please state)		
Is the organism an MDRO?	☐ Y	☐ N			
If yes, which of the following?	☐ MRSA	☐ ESBL	☐ VRE	☐ CRO	☐ Other

Notes (For your own reference. This is not reviewed by the SSII programme)

Appendix 6: Model for Improvement

The SSIIP recommends providers use the Model for Improvement when undertaking improvement projects and activities. This is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organisations internationally (Institute for Healthcare Improvement 2012).

The model has two parts:

1 Three fundamental questions that guide improvement teams to:

- set clear aims
- establish measures that will inform if changes are leading to improvement
- identify changes that are likely to lead to improvement.

2 The plan–do–study–act (PDSA) cycle is used for small-scale tests of change in the real work setting.

Set clear aims (goals and objectives)

Improvement requires setting aims. An organisation will not improve without a clear and firm intention to do so. The aim should be time-specific and measurable. Setting an aim can help teams focus on what they hope to achieve by implementing SSI prevention strategies.

Build a team

It is crucial to have the active support of senior clinicians and leaders in this work. For any surgical care improvement programme to be successful, leadership must make patient safety and quality of care a strategic priority. Once leadership has publicly given recognition and support to the programme, the improvement team can be quite small.

The team should be responsible for:

- conducting small-scale tests of ideas for improvement
- tracking performance on a set of measures designed to help them see if the changes they are making are leading to improvement
- regularly report their findings back to leadership.

Establish measures

Measurement is a critical part of testing and implementing changes; it tells a team whether the changes they are making are actually leading to improvement.

Measurement for improvement starts with collecting baseline data to provide your team with a picture of where you are starting from.

Given the complexity of reducing the outcome measure of SSI, we offer the following tips and suggestions:

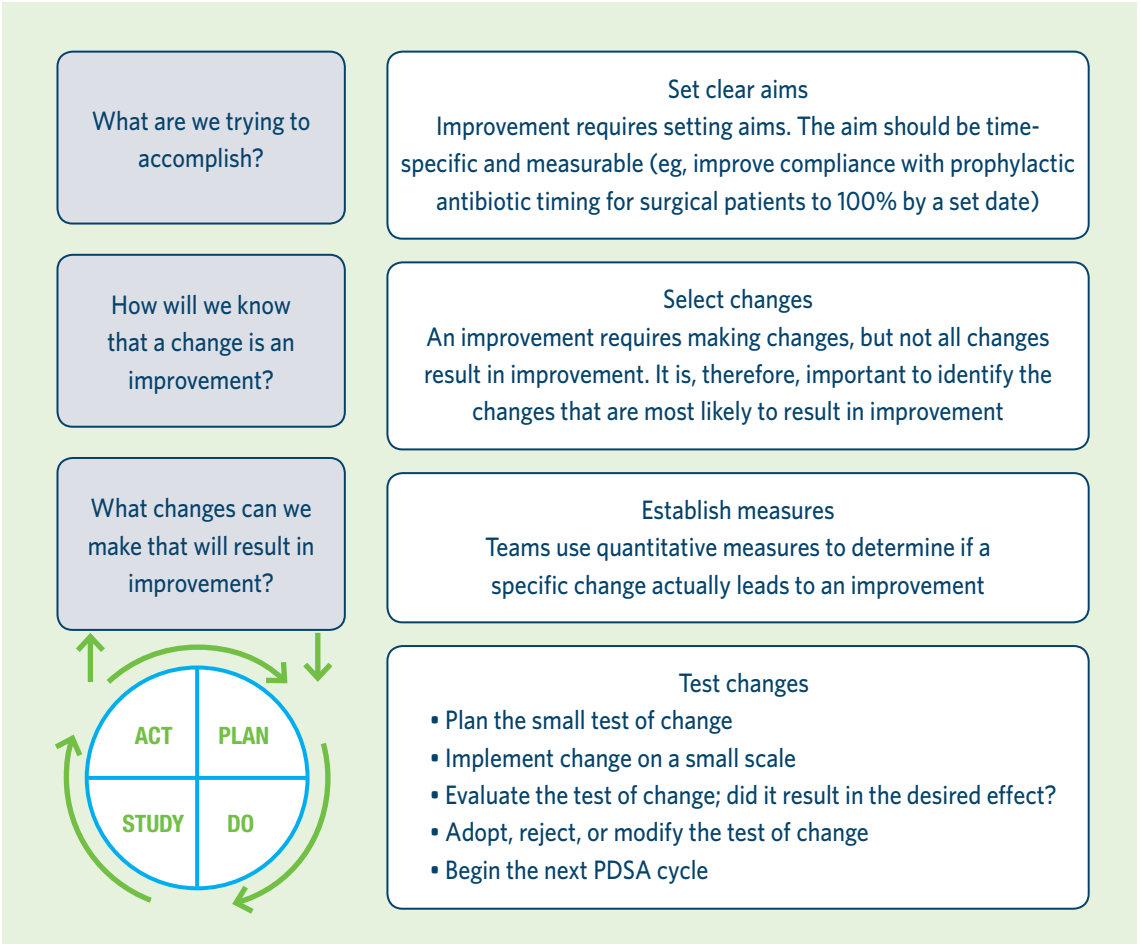
- SSI rates need to be monitored on a long-term basis for trend. A normal variation may be noted in SSI rates even though antimicrobial prophylaxis compliance increases consistently.
- Improvement in SSI rates should be seen as a long-term goal. These events are uncommon, occurring in less than 5 percent of all procedures and improvement will not be seen in the short term.
- Consistently applied best practice for every surgical procedure will influence SSI rates.
- There are many other variables, beyond the guidelines presented, which may affect SSI rates, for example, patient-specific factors such as diabetes, obesity, surgeon experience and technique, and duration of procedure.
- Work closely with your IPC team, clinical microbiologists, infectious disease physicians, surgeons, anaesthetists, operating room nursing staff, pharmacists and information support services to capture the process and outcome measure.

Select changes

The ability to develop, test and implement changes is essential for any individual, group or organisation that wants to continuously improve.

After generating ideas, run PDSA cycles to test a change or group of changes on a small scale to see if they result in improvement. If they do, expand the tests and gradually incorporate larger and larger samples until you are confident the changes should be adopted more widely.

PDSA cycle



Plan – Identify one clinician willing to test a method of ensuring one of the antibiotic prophylactic interventions in this document is being carried out correctly, eg, ensuring antimicrobials are discontinued within 24 hours of surgery.

Do – Undertake the review after a usual operating session the previous day.

Study – At an appropriate point in the day talk to the nurse/doctor/pharmacist involved about how 'user-friendly' the process was.

- Did it fit into the normal pattern of patient follow-up or review?
- Was there anything they would like to see added? How long did it take? Did it pick up any 'glitches'?
- Was it too dependent on someone remembering to do it? How could we make the process better next time?

Act – Make refinements based on the discussion. If the refinements take time to implement, arrange to do this but agree how you could carry on the testing by making refinements as you go along, testing again each time until you can do this successfully for the whole day.

Other guidance

A number of countries including Wales, Canada and the US (NHS Wales 2010, Canadian Patient Safety Institute 2014, Centers for Disease Control and Prevention nd) and jurisdictions within countries (Safety and Quality Investment for Reform 2007) provide guidance on reducing SSI rates. The Joint Commission's Implementation Guide (2013) also provides an overview of evidence-based best practices for preventing SSI.

Appendix 7: Abbreviations used in this document

ACC	Accident Compensation Corporation
ACHI	Australian Classification of Health Interventions
ASA	American Society of Anesthesiologists
ASC	active surveillance culture
AST	active surveillance testing
BSI	bloodstream infection
CARD	cardiac surgery
CBGB	coronary artery bypass graft with chest and donor site incisions
CBGC	coronary artery bypass graft with chest incision only
CDC	Centers for Disease Control and Prevention
CPE	carbapenemase-producing Enterobacteriaceae
CRE	carbapenem-resistant Enterobacteriaceae
CRO	carbapenem-resistant organism
CSV	comma-separated values (file type)
CT	computerised tomography (scan)
DHB	district health board
ESBL	extended spectrum beta-lactamase
IgG	immunoglobulin G
IHI	Institute for Healthcare Improvement
IPC	infection prevention and control
LIMA	left internal mammary artery (graft)
MRI	magnetic resonance imaging
MRSA	methicillin-resistant *Staphylococcus aureus*
MSSA	methicillin-susceptible *Staphylococcus aureus*
NDM	New Delhi metallo-beta-lactamase
NHI	National Health Index
NHSN	National Healthcare Safety Network
OR	operating room
PDS	post-discharge surveillance
PDSA	plan–do–study–act
PVP	povidone-iodine
QCK	quick check
QSM	quality and safety marker
SSI	surgical site infection
SSIIP	Surgical Site Infection Improvement Programme
TAVI	transcatheter aortic valve implantation
VAD	ventricular assist device
VRE	vancomycin-resistant *Enterococcus*
WHO	World Health Organization

SSII Surgical Site Infection Improvement Programme

newzealand.govt.nz

Health Quality & Safety Commission New Zealand
Kupu Taurangi Hauora o Aotearoa