Surgical Site Infections following Total Hip and Total Knee Arthroplasty (TH &TK SSIs) Protocol

Approved by Provincial IPC Surveillance Committee: March 2012
Revised: April 2025

Alberta Health Services
Infection Prevention & Control

Contents

Introduction

Hospital-acquired infections are infections that are an adverse event resulting from an admission to an acute care setting (Klevens et al., 2007). About 20% of hospital-acquired infections are surgical site infections (SSIs) (Leaper, 2010). The incidence rate of SSI varies from 2-15% depending on multiple factors including the type of operation (Castella et al., 2010). Rates vary between surgeons, by facility and between countries (Leaper et al., 2004). They are costly to the healthcare system, and many can be prevented through surveillance activities (Plowman et al., 2001). While many surgeries can be followed for the development of SSIs, the provincial focus is on SSIs related to total hip and knee arthroplasty, as infections are one of the most serious complications, occurring in 0.5% to 3.83% of these surgeries (Minnema, Vearncombe, Augustin, Gollish, & Simor, 2004; Huotari, Lyytikäinen, Seitsalo, & Hospital Infection Surveillance Team, 2007).

Surveillance for SSIs that involve Infection Control Professionals and feedback to stakeholders have been shown to be associated with reductions in rates of SSIs (Brandt et al., 2006; Gaynes et al., 2001; Wilson, Charlett, Leong, McDougall, & Duckworth, 2008).

In conjunction with the Total Hip and Total Knee surveillance protocol, there are six supporting documents to assist in the interpretation and practical use of this protocol:

- Protocol-specific and general surveillance definitions (Appendix A and Appendix B)
- A list of included and excluded surgical orthopedic procedures (Appendix C)
- Casefinding process (Appendix D)
- ICD-10-CA code used in the casefinding process (Appendix E)
- SSI User Guide (Alberta Health Services [AHS], 2018).

Goal

To decrease rates of SSIs following Total Hip and Total Knee arthroplasty procedures (THA/TKA - see Appendix A) in Alberta Health Services (AHS) and Covenant Health facilities.

Objectives

1. To determine provincial, zone and facility SSI rates for THA or TKA performed in Alberta.
2. To provide useable data leading to interventions aimed at reducing the rate of SSIs for patients undergoing THA or TKA.
3. To investigate increases or significant SSI rates for patients undergoing THA or TKA.
4. To establish quarterly and annual SSI incidence rates following THA or TKA for trend analysis over time and to compare with internal and external benchmarks.

Methodology

Patient population

All patients who had a primary, clean, elective THA or TKA at AHS/Covenant Health acute care facilities or chartered surgical facilities. Acute and acute tertiary rehabilitation facilities and chartered surgical facilities (CSFs) will be referred to as the “facilities under surveillance” in this protocol for simplicity. Please refer to Appendix A and Appendix B: for facilities that would be included under this term.

Case definition

According to the Centre for Disease Control/National Healthcare Safety Network (2022), SSIs are divided into three categories:

1. Superficial incisional SSI
2. Deep incisional SSI
3. Organ/Space SSI

Surveillance for Total Hip and Total Knee SSIs will be performed for all included procedures until 90 days after the date of the surgical procedure even if the patient has been discharged. Once a possible case is detected, the Infection Control Professional will review the case and determine whether the case meets the criteria for either a **deep or organ / space infection**.

Inclusion criteria

- Primary total hip or knee arthroplasty (i.e. first total arthroplasty for that joint), including resurfacing procedures – see Appendix C.

AND

- Clean procedures

AND

- Elective procedures

Exclusion criteria

- Infections classified as Superficial incisional SSIs (optional data entry-see Appendix D)
- Hemiarthroplasty and revision procedures (Appendix C)
- Procedures classified as clean-contaminated, contaminated and dirty-infected
- Procedures in which the patient died within 24 hours from the procedure and
- If during the postoperative period the original THA or TKA surgical site has an invasive manipulation for diagnostic or therapeutic purposes (e.g. needle aspiration, irrigation and debridement) and there is no evidence of an infection at that time. If an SSI develops following this manipulation, the infection is not attributed to the operation. Invasive manipulation does not include wound packing or changing of wound packing materials as part of postoperative care (Centers for Disease Control [CDC], 2025).

Other considerations - Identifying SSIs

Possible cases may be detected at these points in time, but are not limited to:

1. While admitted in an AHS/Covenant Health facility following THA or TKA.
2. When seen in the emergency department or admitted to an AHS/Covenant Health facility following their THA or TKA.
3. Orthopedic surgeon operative (OR) reports following the THA or TKA.
4. Through an administrative review of patients who had a THA or TKA and were coded as having an infection following their surgery (NOTE: this will be the primary source for detection of SSIs at CSFs).

Case detection while in an AHS/Covenant Health facility can involve review of any of the following:

- Microbiology laboratory results
- Patient charts including observation of the incision, nursing, physician, and pharmacy data
- Re-operation records
- Readmissions
- Emergency visit records and
- Clinic visit records.

Data collection and data entry

Mandatory data entry

- Deep incisional or organ/space SSIs meeting the Centre for Disease Control/National Healthcare Safety Network SSI definition following a primary, clean, elective THA or TKA are mandatory data entry.
- Each Infection Control Professional or IPC designate will be responsible for timely entry of the surveillance data into the provincial surveillance platform. It is expected that the minimum data set is collected and entered in a timely manner after factoring in follow-up time, initial case detection, work-up and distribution to Infection Control Professionals and/or IPC offices. As a recommendation, data entry should be completed by an Infection Control Professional or IPC designate within 1-2 weeks of identifying an SSI or within 4 weeks of being provided a case for review following the administrative casefinding process.

Minimum case information

Basic demographic, facility and possible microbiological data will be collected for cases and must include:

- Name (first, middle, last)
- Date of birth
- Gender
- Alberta Personal Healthcare Number (PHN) (or Unique Lifetime Identifier (ULI))
- Facility medical record number (where applicable)
- Admission date to reporting facility
- Reporting Zone and facility name
- Culture date, laboratory name, accession number and cultured site (if applicable)
- Date of surgery and facility where procedure performed
- Type of surgery (Total Hip Replacement, Total Knee Replacement)
- Infection type (Deep incisional or Organ/space)
- American Society of Anesthesiologists (ASA) score (if known) (Daabiss, 2011)
- Antibiotic prophylaxis information (if known)
- Classification (Wound class).

Denominator data

The number of total arthroplasty procedures for hips and knees is obtained from Alberta Bone and Joint Health Institute (ABJHI). The ABJHI is the source of truth of denominators for this surveillance protocol.

Rate calculation

Rates	Calculations
Infection rates (per 100 procedures)	$\frac{\text{Number of infections}}{\text{Number of procedures}} \times 100 \text{ procedures}$

Note: Only complex SSI (deep incisional and organ/space) will be reported.

Comparator rates

Internal and external surveillance rates are used as comparators. The internal rates are the historical rates for the province from the previous fiscal year. The external rates are provided by the Canadian Nosocomial Infection Surveillance Program (CNISP).

Reporting

Communication and dissemination of surveillance reports is an integral part of surveillance, to inform IPC practice within AHS and Covenant Health facilities and provide support for interventions that improve the quality of patient care delivered. Responsibility for compiling, reporting, and disseminating data and reports is shared between provincial IPC Surveillance and Standards and the provincial IPC program. Formal reports are generated quarterly using reconciled and validated data, although data from the most recent reporting quarter should be interpreted with caution as case validation using administrative data has a one-quarter delay. The reports contain information on the facility and provincial level and are presented to the provincial IPC Surveillance, Evaluation, Quality Improvement and Research committee for approval (AHS, 2023). Operational reports are created by local Infection Control Professionals or their designate and may or may not consist of reconciled and validated data, as they are often created with real-time, as is, data.

Data quality

The purpose of evaluating the quality of data is to ensure that SSI-related events are monitored efficiently and effectively. The evaluation should involve the assessment of the program (i.e., the protocol, and reporting) and system (i.e., electronic data collection tool) attributes, including relevance, simplicity, flexibility, data quality, acceptability, consistency, representativeness, timeliness and stability. Additionally, with increasing use of technology, informatics concerns for surveillance systems need to be addressed. These include evaluating hardware and software, using a standard user interface, applying standard data formatting and coding, performing quality checks and adhering to confidentiality and security standards.

A standardized approach is used to reconcile and validate the data, provincially. The first component of data reconciliation and validation of data in the provincial surveillance platform ensures that demographic data is valid and reliable. The second component entails ensuring that the SSI-related events are entered in a manner that is consistent with the protocol definitions. At this latter stage, outliers are identified, and requests are sent to the Infection Control Professionals to verify that the data was correctly entered, and definitions were consistently applied according to the provincial surveillance protocol. Final designation of cases is a collaborative effort between the facility-based Infection Control Professionals and the epidemiologists/analysts of the IPC Surveillance and Standards Team.

Algorithms are continuously being updated and added to ensure capture of as many discrepancies as possible. In addition to this current process of data review, there will be data audits using external data sources to determine the validity and reliability of the data in the provincial surveillance platform - see Appendix D. The data will also serve to inform decisions made by the IPC Surveillance and Standards Team to improve surveillance processes and methodologies.

Data quality working group

The IPC Surveillance Data Quality Working Group reports to the IPC Surveillance Committee and is responsible to develop, review and update indicator protocols to include the precise methodology for data collection to ensure consistency. Decisions from the Data Quality Working Group on specific protocol questions are communicated to provincial Infection Control Professionals through the Data Quality Forum and will be included in the protocol User Guide. These decisions will be supplemental to the protocol and will be incorporated into the protocol, when revised.

Protocol revision history

Date	Details
April 2012	Protocol approved by Surveillance Committee.
April 2014	
April 2017	
April 2018	
March 2019	Protocol style updated; reference style changed to APA.
Spring 2020	Updated to new template and reposted to web page.
April 2021	Updated references.
April 2022	Updated references.
April 2023	• Changed reporting process from IPC Surveillance Committee to IPC Surveillance, Evaluation, Quality Improvement and Research Committee • Updated casefinding to reflect quarterly review cycles • Updated long term care definition • Updated references.
April 2024	• Changed terminology from “replacement procedure” to “arthroplasty” and used acronyms THA and TKA throughout – Added terms to Appendix A • Revised methodology to include procedures performed at chartered surgical facilities • Updated casefinding methodology in Appendix D to specify that superficial SSIs are optional data entry and added reference in exclusion criteria • Added Appendix A – protocol specific definitions, updated linkages to all Appendices • In methodology, clarified that the orthopaedic surgeon reports would be the operative (OR) reports • Clarified relevant encounter types in Appendix B • Removed reference to ProvSurv – used “provincial surveillance platform” • Reference to supporting documentation in the “Introduction” changed to a bulleted list • Removed definition for infection window period from General surveillance definitions • Updated references.
April 2025	• Removed reference to LTC and replaced with Continuing Care Home Type A – updated definition and added link to continuing care website for source of truth • Updated definition for patient admissions denominator

	• Added this statement to other considerations – identifying SSIs: "Through an administrative review of patients who had a THA or TKA and were coded as having an infection following their surgery (NOTE: this will be the primary source for detection of SSIs following THA or TKA at chartered surgical facilities)" • Updated the mandatory data entry section to include a statement around timeframe for entering cases identified from casefinding (bold added for emphasis): As a recommendation, data entry should be completed by an Infection Control Professional or IPC designate within 1-2 weeks of identifying an SSI **or within 4 weeks of being provided a case for review following the administrative casefinding process** • Comparator rates are no longer provided by zone, so removed that reference • Added the following statement to the "Data Reports" section: Formal reports are generated routinely (usually quarterly) using reconciled and validated data, **although data from the most recent reporting quarter should be interpreted with caution as case validation using administrative data has a one-quarter delay** • Added clarity to the timeline in Appendix D: Casefinding process • Updated "casefinding" to IPC Standard Preference.

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Appendix A: Protocol - specific definitions

Terms	Definitions
American Society of Anesthesiologists' (ASA) score	A subjective assessment of a patient's overall health that is based on five classes (I, patient is a completely healthy fit patient; II, patient has mild systemic disease; III, patient has sever systemic disease that is not incapacitating; IV, patient has incapacitating disease that is a constant threat to life; V, a moribund patient who is not expected to live 24 hour with or without surgery) (Daabiss, 2011)
Wound Class	Surgical procedures are traditionally classified by the Centre for Disease Control into four groups: clean, clean-contaminated, contaminated, and dirty-infected. These categories are based on the variable level of risk of SSI due to microbial load found in various locations of the body in the patient as well as the type of surgery (Centers for Disease Control and Prevention, 2025).
Clean (Class I)	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tracts are not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non-penetrating (blunt) trauma should be included in this category if they meet the criteria.
Clean-Contaminated (Class II)	Operative wounds in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
Contaminated (Class III)	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered including necrotic tissue without evidence of purulent drainage (e.g., dry gangrene) are included in this category.
Dirty-infected (Class IV)	Includes old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.
Chartered Surgical Facilities (CSF)	AHS is dedicated to ensuring Albertans have access to high-quality and safe care. AHS developed the Alberta Surgical Initiative (ASI), a five-step plan to improve surgery in Alberta. One of these steps includes improving access to surgery through expanded services and partnerships, including chartered surgical facilities (CSFs). These CSFs must follow the rules set forth in the Alberta's Health Facilities Act (HFA) and HFA Regulation regarding the sale of enhanced medical goods and services. A list of current agreements with CSFs and clinics can be located here: https://www.albertahealthservices.ca/about/Page3172.aspx
Total Hip Arthroplasty (THA)	Also known as total hip replacement (THR) – the damaged bone and cartilage in the hip joint is removed and replaced with prosthetic components
Total Knee Arthroplasty (TKA)	Also know as total knee replacement (TKR) – the damaged bone and cartilage in the knee joint is removed and replaced with prosthetic components

Appendix B: General surveillance definitions

Terms	Definitions
Encounter types	Type of AHS/Covenant Health healthcare location or facility where the patient is located at the time of identification. The following encounter types are referred to in acute care surveillance protocols (Government of Alberta, 2008; Government of Alberta, 2025). • **Inpatient acute care:** Refers to a General Hospital: According to the Hospitals Act, a general hospital is defined as a "hospital providing diagnostic services and facilities for medical or surgical treatment in the acute phase for adults and children and obstetrical care" (Government of Alberta, 2025). General hospitals have several functional centres. Each functional centre is associated with inpatient, outpatient, or diagnostic and therapeutic services. • **Inpatient mental health/rehab**: A designated mental health facility providing diagnosis and treatment for mental illness and addiction in the acute phase for adults and children. Inpatient services refer to a person admitted to and assigned a bed in a facility by order of a physician for provision of diagnostic and/or treatment services. They would have a patient/group room in which inpatient services are provided within the patient's room or within a common group room within the designated mental health facility. AHS facility examples include Glenrose Rehabilitation Hospital, Centennial Centre for Mental Health and Brain Injury.
Infection prevention and control baseline	A comparator rate created for each acute care facility in the IPC Surveillance on-line dashboards and reporting modules, to guide efforts to reduce healthcare-associated infections. The IPC baseline is based on reported monthly rates for the previous fiscal year. The calculation excludes the monthly rates higher than 1 Standard Deviation above the 12-month average but includes all rates where the site had optimal performance. This calculation method biases the IPC baseline rate towards zero, to focus on the best patient safety outcomes.
Continuing Care Home (CCH) Type A (formerly Long Term Care)	This environment provides onsite RN and/or registered psychiatric nurse (RPN) care, assessment and/or treatment 24-hours a day. Licensed practical nurses (LPNs) may also be onsite in addition to onsite personal care and support provided by health care aides (HCAs). CCH Type A may also have a secure space. Some sites may have specialized programs and services available for residents with complex clinical or complex functional care requirements (e.g., rehabilitation) (Alberta Health Services, 2025). To identify if a facility has CCH Type A beds refer to this website: https://www.albertahealthservices.ca/cc/page15328.aspx where you can search by Name and identify what type of beds the facility has.
Patient admission (aka inpatient admissions)	A person admitted to and assigned a bed in a hospital by the order of a physician, for the provision of diagnostic or treatment services or both. Includes a person who spends any time in the emergency department if assigned a bed in hospital, regardless of whether the patient was transferred to an inpatient unit and patients who are directly admitted to an inpatient unit. This is the denominator used for non-hospital-acquired rates (see Rate Calculation Section) (Government of Alberta, 2025).
Patient days (aka inpatient days)	As defined by AHS, this is used to create the denominator for hospital-acquired or hospital-identified cases. The total is equal to midnight census with patients admitted and discharged on the same day counted as a one day stay. It includes patients out on a pass. Day of admission is counted but the day of separation (discharge, death or transfer out of hospital) is not counted. Patient-days are included for inpatient encounters where discharge date is not recorded in the data source. Inpatient totals exclude the time patients are waiting in the emergency department for an inpatient bed (time from decision to admit to discharge from emergency department).

Terms	Definitions
Emergency department inpatient days (EDIP)	As defined by AHS, denominators for provincial surveillance modules include these figures in the total patient-days. Includes the number of acute care inpatient patient-days utilized in the emergency department during the reporting period. The figures reflect the time from emergency department discharge (i.e. decision to admit) to emergency department departure for patients admitted to an acute care hospital. It is calculated as [(emergency department departure date and time – emergency department discharge date and time) ÷ 60 ÷ 24]. Figures exclude cases where the emergency department discharge date and time or emergency department departure date and time were not provided, or the value has a negative number.

Appendix C: Included and excluded orthopedic surgical procedures

Procedure	Description	CCI
Included in denominator		
Hip Resurfacing **Birmingham Hip Resurfacing**	The procedure consists of placing a cobalt-chrome metal cap, over the head of the femur while a matching metal cup is placed in the acetabulum replacing the articulating surfaces of the patient's hip joint and removing very little bone.	1VA53LAPN 1VA53LLPN
Total Hip Replacement (TH) **Arthroplasty, Replacement, Hip**	Replacement of both femoral head and acetabulum by prosthesis. All techniques including posterior, lateral, antero-lateral, anterior approach and minimally invasive approaches are included.	1VA53LAPN 1VA53LLPN
Total Knee Replacement (TK) **Arthroplasty, Replacement, Knee**	Total knee replacement includes bicompartmental and tricompartmental arthroplasty.	1VG53LAPN 1VG53LAPP
Patellofemoral Arthroplasty	Implantation of internal device, patella	1VP53
Excluded from Denominator		
Partial Hip Replacement **Hemiarthroplasty**	Partial hip replacement, also called hip hemiarthroplasty, is a surgical procedure where only the femoral head of the damaged hip joint is replaced. The acetabulum is not replaced.	1VA53LAPM 1VA53PNPM 1SQ53
Partial Knee Replacement **Hemiarthroplasty**	Partial Knee Prosthesis involves only one compartment of the knee. Also called unicompartmental arthroplasty (UKA)	1VG53LAPM
(ORIF) Open Reduction and Internal Fixation or Closed Reduction	Open reduction internal fixation (ORIF) with irrigation and debridement of open fracture. Closed reduction and screw fixation of right femoral neck fracture or any removal of hardware.	1VA74* 1VC74*
***Revision of Hip Replacement**	Revision total hip arthroplasty, involves the removal a previously implanted artificial hip joint, or prosthesis, and replaces it with a new prosthesis.	1VA53LAPN 1VA53LLPN
***Revision of Knee Replacement**	Revision total knee arthroplasty involves the removal a previously implanted artificial hip joint, or prosthesis, and replaces it with a new prosthesis.	1VG53LAPN 1VG53LAPP

*If an SSI develops prior to revision surgery the SSI is included in the numerator. If an SSI develops as a result of a revision do not report as not included in provincial surveillance.

Appendix D: Surveillance team casefinding process

Diagnosis and procedure codes for 90 days following the patient's Total Hip/Total Knee procedure are used to identify potential SSI cases. This casefinding process repeats every 90 days. Medical charts of patients with potential SSIs are reviewed by an Infection Control Professional at the acute care facility where the patient was identified with a diagnosis or procedure code. (NOTE: this will be the primary source for detection of SSIs following THA or TKA at chartered surgical facilities).

Activity	Steps	Timelines for Quarter 3 procedures
Surveillance data range	Six months of patient procedures reviewed in this cycle, including procedures in timeframe under review, and repeat review for last quarter. Denominator data source: Alberta Bone and Joint Health Institute.	July to Dec 2024
Data request to analytics	Analytics query – link denominator to ICD-10-CA diagnosis codes (see Appendix E) / CCI procedure codes (see Appendix C) for 90 days following last procedure date.	May 2025
Surveillance analysis	Run pre-written R script; compare results to provincial surveillance platform (known SSI cases). Exclude records reviewed in the previous casefinding cycle.	May 2025
Results to infection control professionals	Send patients with suspicious readmissions to infection control professionals, cc directors for additional casefinding.	(5 months following end of surveillance quarter) May 2025
Casefinding back from infection control professionals	Responses required indicating investigation and response for all patients.	(4 weeks after receiving cases for review) June 2025
Data entry into provincial surveillance platform	Infection control professionals to enter confirmed complex SSI cases into the provincial surveillance platform. Superficial SSI cases are optional data entry and must occur within 30 days of surgery to be eligible for data entry. For SSI cases identified by Infection Control Professionals at a facility that did not perform the original Total Hip/Total Knee procedure, the Infection Control Professional identifying the SSI must contact a procedure facility infection control professional prior to entering into the provincial surveillance platform.	June 2025
Surveillance SSI report date	Update SSI rates based on new numerator information.	(7 months following end of surveillance quarter) July 2025 (or next report date)

Appendix E: ICD-10-CA code used in the casefinding process

ICD-10-CA	Description
T814	Infection following a procedure not elsewhere classified includes: Abscess: • intra-abdominal postprocedural • stitch postprocedural • subphrenic postprocedural • wound postprocedural Sepsis postprocedural Excludes infection due to: • infusion, transfusion and therapeutic injection (T80.2) • prosthetic devices, implants and grafts (T82.6-T82.7) (T83.5-T83.6) (T84.5-T84.7) (T85.7) obstetric surgical wound infection (O86.0) specified infections classified elsewhere, such as: • cholangitis (K83.02) • pneumonia (J12-J18) surgical wound infection of amputation stump or reattached body part (T87.0-, T87.1-, T87.201), (T87.4-)
T8182	Persistent postoperative fistula
T8453	Infection and inflammatory reaction due to hip prosthesis
T8454	Infection and inflammatory reaction due to knee prosthesis
T8458	Infection and inflammatory reaction due to other joint prosthesis
T8459	Infection and inflammatory reaction due to unspecified joint prosthesis
T847	Infection and inflammatory reaction due to other internal orthopaedic prosthetic devices, implants and grafts
T857	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts