

# **Surgical Site Infections following Total Hip and Total Knee Replacement (TH & TK SSIs) Protocol**

**Approved by Provincial IPC Surveillance Committee: March 2012  
Revised: April 2023**

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## 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 (ICPs) 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 – the SSI 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](#)) and the ProvSurv User Guide (Alberta Health Services [AHS], 2018).

## Goal

To decrease rates of SSIs following Total Hip and Total Knee replacements in Alberta Health Services (AHS) and Covenant Health facilities.

## Objectives

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

## Methodology

### Patient population

All hospitalized patients of AHS/Covenant Health acute care facilities where inpatient care is provided 24 hours/day, 7 days a week and where primary, clean, elective total hip or knee replacements are performed. Acute and acute tertiary rehabilitation facilities will be referred as the “facilities under surveillance” in this protocol for simplicity. Please refer to [Appendix B](#): General Surveillance Definitions 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 ICP 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;
- 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 total hip or total knee replacement 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], 2022).

### Other considerations - Identifying SSIs

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

- While admitted in an AHS/Covenant Health facility following total hip or knee replacement;
- When seen in the emergency department or readmitted to an AHS/Covenant Health facility following discharge from the surgery stay; and
- Orthopedic surgeon reports following total hip or knee replacement.

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, physician record and pharmacy data);
- Re-operation records;
- Readmissions;
- Emergency visit records;
- Clinic visit records; and
- Administrative discharge data review.

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# Data collection and data entry

## Mandatory data entry

- All SSIs meeting the Centre for Disease Control/National Healthcare Safety Network SSI definition following a primary, clean, elective total hip or knee replacement are mandatory data entry.
- Each ICP or IPC designate will be responsible for timely entry of the surveillance data into ProvSurv. It is expected that the minimum data set is collected and entered into ProvSurv in a timely manner after factoring in follow-up time, initial case detection, work-up and distribution to ICPs and/or IPC offices. As a recommendation, data entry should be completed by an ICP or IPC designate within 1-2 weeks of identifying an SSI.

## 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 (Superficial incisional, Deep incisional or Organ/space);
- American Society of Anesthesiologists (ASA) score (if known) (Daabiss, 2011);
- Antibiotic prophylaxis information (if known); and
- 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)	$\frac{\text{Number of infections}}{\text{Number of procedures}} \times 100$ procedures

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

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## Comparator rates

Internal and external surveillance rates are used as comparators. The internal rates are the historical rates for the province or zone 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 routinely (usually quarterly) using reconciled and validated data. The reports contain information on the facility, zone 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 ICPs 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 being 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 the 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 ProvSurv 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 ICP to verify that the data was correctly entered, and the definitions were consistently applied according to the provincial surveillance protocol. Final designation of cases is a collaborative effort between the facility-based ICPs and the epidemiologists/analysts of the IPC Surveillance and Standards Team.

Further use of statistical software for validating records is still in development. 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 ProvSurv - see [Appendix C](#). The data in ProvSurv 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 ICPs 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.

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## 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	<p>Changed reporting process from IPC Surveillance Committee to IPC Surveillance, Evaluation, Quality Improvement and Research Committee.</p> <p>Updated case-finding to reflect quarterly review cycles.</p> <p>Updated LTC definition.</p> <p>Updated references.</p>

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## Appendix A: General surveillance definitions

Terms	Definitions
<b>Encounter types</b>	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, 2022).
<b>Continuing care</b>	An integrated range of services supporting the health and wellbeing of individuals living in their own home, a supportive living or long-term care setting. Continuing care clients are not defined by age, diagnosis or the length of time they may require service, but by their need for care.
<b>Long-term care</b>	Long term care facilities include auxiliary hospitals and nursing homes reserved for those with unpredictable and complex health needs who require 24-hour nursing care. Residents of long-term care facilities usually have multiple chronic and/or unstable medical conditions. Specialized services such as respite, palliative care, case management, rehabilitation therapy, as well as services for advanced Alzheimer's and dementia are available at these facilities. A list of certified long-term care facilities in Alberta Health Services can be found on the COMMON-PROVINCIAL Surveillance drive. In this file, if the site has "LTC" listed in the "Accommodation Subtype II" column, it will qualify as a LTC site. If the site has "LTC" AND another type (i.e. subacute in LTC) listed in the column we would assume they are from a site that offers LTC.
<b>Auxiliary hospital</b>	A facility designated for the provision of medical services to in-patients who have long-term or chronic illnesses, diseases or infirmities. Services may include acute palliative programs, geriatric day programs or day/night programs. They may include functional centres such as long-term care, medical or clinical areas.
<b>Emergency</b>	Emergency Departments take care of people that are very sick or injured on a priority basis by providing medical care, which may include assessment, treatment, stabilization to prepare people for transport to a higher level of care facility (if needed) and follow-up care, including referrals to a family doctor or specialist (if needed). This option can be used to capture outpatient encounters when a patient visited the emergency department at a facility and did not subsequently get transferred to an inpatient unit, but rather returned back to his/her home setting.
<b>Inpatient acute care</b>	Refers to a General Hospital: According to the <i>Hospitals Act</i> , 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, 2022). General hospitals have several functional centres. Each functional centre is associated with in-patient, outpatient, or diagnostic and therapeutic services.
<b>Inpatient mental health/rehab</b>	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.
<b>Infection window period</b>	The 7-days during which all site-specific infection criteria must be met. It includes the day of the first positive diagnostic test (i.e., lab specimen collection, imaging test, procedure or exam, physician diagnosis and initiation of treatment) that is an element of the site-specific infection criterion, was obtained, the 3 calendar days before and the 3 calendar days after. For site-specific infection criteria that do not include a diagnostic test, the first documented localized sign or symptom that is an element of National Healthcare Safety Network infection criterion, excluding SSIs, should be used to

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Terms	Definitions
	define the window (i.e., diarrhea, site specific pain, purulent exudate).
<b>Infection prevention and control baseline</b>	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.
<b>Patient admission</b>	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 any time in the emergency department where the patient is subsequently transferred to an inpatient unit. This is the denominator used for non-hospital-acquired rates (see Rate Calculation Section) (Government of Alberta, 2022).
<b>Patient days</b>	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).
<b>Emergency department inpatient days (EDIP)</b>	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 B: Included and excluded orthopedic surgical procedures

Procedure	Description	CCI
<b>Included in denominator</b>		
<b>Hip Resurfacing Birmingham Hip Resurfacing</b>	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
<b>Total Hip Replacement (TH) Arthroplasty, Replacement, Hip</b>	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
<b>Total Knee Replacement (TK) Arthroplasty, Replacement, Knee</b>	Total knee replacement includes bicompartamental and tricompartmental arthroplasty.	1VG53LAPN 1VG53LAPP
<b>Patellofemoral Arthroplasty</b>	Implantation of internal device, patella	1VP53
<b>Excluded from Denominator</b>		
<b>Partial Hip Replacement Hemiarthroplasty</b>	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
<b>Partial Knee Replacement Hemiarthroplasty</b>	Partial Knee Prosthesis involves only one compartment of the knee. Also called unicompartmental arthroplasty (UKA)	1VG53LAPM
<b>(ORIF) Open Reduction and Internal Fixation or Closed Reduction</b>	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*
<b>*Revision of Hip Replacement</b>	Revision total hip arthroplasty, involves the removal a previously implanted artificial hip joint, or prosthesis, and replaces it with a new prosthesis.	1VA53LAPN 1VA53LLPN
<b>*Revision of Knee Replacement</b>	Revision total knee arthroplasty involves the removal a previously implanted artificial hip joint, or prosthesis, and replaces it with a new prosthesis.	1VG53LAPN 1VG53LAPP

(Canadian Institute for Health Information [CIHI], 2015a)

\*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.

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## Appendix C: Surveillance team casefinding process

Diagnosis and procedure codes for 90 days following the patients Total Hip/Total Knee procedure are used to identify potential SSI cases. This case-finding process repeats every 90 days. Medical charts of patients with potential SSIs are reviewed by an ICP at the acute care facility where the patient was identified with a diagnosis or procedure code.

Activity	Steps	Timelines
<b>Surveillance data range</b>	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.	Oct-Dec 2022
<b>Data request to analytics</b>	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 2023
<b>Surveillance analysis</b>	Run pre-written SPSS Syntax; compare results to ProvSurv (known SSI cases). Examine the diagnosis codes for those known patients (which will lend some confidence in using particular diagnosis codes for finding cases that are not in ProvSurv). Exclude records reviewed in the previous casefinding cycle.	May 2023
<b>Results to infection control professionals</b>	Send patients with suspicious readmissions to infection control professionals, cc directors for additional casefinding.	May 2023
<b>Casefinding back from infection control professionals</b>	Responses required indicating investigation and response for all patients.	June 2023
<b>ProvSurv data entry</b>	Infection control professionals to enter confirmed SSI cases into ProvSurv. 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 ProvSurv.	Jun 2023
<b>Surveillance SSI report date</b>	Update SSI rates based on new numerator information.	Jul 2023 (or next report date)

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

ICD-10-CA	Description
T814	<p>Infection following a procedure not elsewhere classified includes:</p> <p>Abscess:</p> <ul style="list-style-type: none"> <li>• intra-abdominal postprocedural</li> <li>• stitch postprocedural</li> <li>• subphrenic postprocedural</li> <li>• wound postprocedural</li> </ul> <p>Sepsis postprocedural</p> <p>Excludes infection due to:</p> <ul style="list-style-type: none"> <li>• infusion, transfusion and therapeutic injection (T80.2)</li> <li>• prosthetic devices, implants and grafts (T82.6-T82.7) (T83.5-T83.6) (T84.5-T84.7) (T85.7)</li> </ul> <p>obstetric surgical wound infection (O86.0)</p> <p>specified infections classified elsewhere, such as:</p> <ul style="list-style-type: none"> <li>• cholangitis (K83.02)</li> <li>• pneumonia (J12-J18)</li> </ul> <p>surgical wound infection of amputation stump or reattached body part (T87.0-, T87.1-, T87.201), (T87.4-)</p>
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

(CIHI, 2015b)

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