Frequently Asked Questions—In-Hospital Sepsis

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Canadian Institute
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Background and rationale

What is in-hospital sepsis?

Sepsis is a clinical syndrome that occurs as a complication of an infection. It is defined as a systemic inflammatory response due to infection. Sepsis is a leading cause of mortality and is linked to increased hospital resource utilization and prolonged stays in intensive care units. Appropriate preventive and therapeutic measures during a hospital stay can reduce the rate of infections and/or progression of infection to sepsis.

In-hospital sepsis refers to sepsis events identified after admission to an acute care hospital. Cases of in-hospital sepsis are not limited to severe sepsis; organ failure or septic shock may be present or absent.

What are the goals of developing an in-hospital sepsis indicator?

The indicator addresses the extent to which acute care hospitals are effective in preventing the development of sepsis. Preventing and treating infections help reduce the risk of developing sepsis. As the first pan-Canadian in-hospital sepsis indicator, it allows for comparisons and monitoring over time at the facility, regional and provincial/territorial levels. It will help hospitals improve patient safety and learn best practices from their peers regarding the appropriate treatment of infections and prevention of sepsis (see the list of best practices resources in the appendices). Health regions and jurisdictions may also use this information for planning, accountability and benchmarking efforts.

Why and how has CIHI developed this indicator?

Sepsis mortality has been monitored via the Hospital Standardized Mortality Ratio (HSMR) by many facilities, for many years. In 2009, a CIHI report—*In Focus: A National Look at Sepsis*—identified sepsis as a major cause of death. In addition, sepsis mortality has not improved over time. Since the release of the report in 2009, several clinical experts who contributed to the report recommended the development of a specific indicator on the occurrence of sepsis. We formally started developing the indicator in 2013 and have engaged specialists in the field to contribute to the development of the concept, definition and methodology. Then, as part of our standard new indicator development process, we shared the consolidated definition, methodology and results with all facilities and jurisdictions across the country. Based on the feedback we received, the indicator was finalized for public release.

Is there a difference in what the in-hospital sepsis indicator measures compared with what the In Focus report measured?

There are a few methodological differences in identifying in-hospital sepsis events for the in-hospital sepsis indicator, compared with the 2009 In Focus report on sepsis. The current indicator is designed to identify sepsis events after admission, whereas the 2009 report focused on hospitalizations related to any sepsis event, regardless of whether it was identified before or after admission. Most notably, the current indicator excludes some patient groups such as palliative care and infants. Also excluded from the in-hospital sepsis indicator definition are the ICD-10-CA (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada) codes for sepsis events caused by microorganisms that are rarely seen in hospital settings. One of the reasons these exclusion criteria were applied was to eliminate sepsis events that may have occurred prior to admission from the numerator. In addition, we were able to use more specific criteria to identify in-hospital sepsis events due to improved coding standards since the release of the report.

Methodology

How is a sepsis event identified?

We identify sepsis events by capturing diagnosis codes describing sepsis, septic shock and/or puerperal sepsis based on the ICD-10-CA. (The complete list of ICD-10-CA codes can be found in the Indicator Library.) Conditions are included if they are identified as a sepsis event that arises post-admission (including those that were associated with a service transfer or became the most responsible condition during a hospital stay), a sepsis event related to a post-surgical infection or an obstetric infection identified during the hospital stay. For this indicator, the list of ICD-10-CA codes from CIHI's 2009 In Focus report on sepsis were refined based on literature review and collaboration with CIHI's Classifications team and an expert advisory group.

Are selected patient groups excluded from the analyses?

- Patients younger than age 1 are excluded from the calculation because they have different mechanisms and risk factors for developing sepsis, as well as to account for differences in coding standards. Therefore, sepsis events in infants and neonatal sepsis are not captured.

- Patients with mental illness conditions are excluded to account for differences in data collection between Ontario and other provinces and territories.

- Patients with palliative care are also excluded.

- Patients with hospital stays shorter than 2 days are excluded.

Which sepsis events are not captured by this indicator?

- Codes describing sepsis events due to microorganisms that are rarely seen during a hospital stay are not included. Examples are *Salmonella sepsis* (ICD-10-CA: A02.1) and *Anthrax sepsis* (ICD-10-CA: A22.7).

- When a discharge abstract contains more than 1 sepsis code and there is no clear documentation that all sepsis codes are describing sepsis event(s) that occurred post-admission, that abstract is excluded from the numerator due to unclear documentation of an in-hospital event. There are 2 examples provided below. For details, please see the Description and Calculation: Numerator Exclusions section of the Indicator Library.

  - An abstract with *Sepsis due to Streptococcus, group A* (ICD-10-CA: A40.0) coded as type (1) (pre-admit comorbidity) and *Other streptococcal sepsis* (ICD-10-CA: A40.8) coded as type (2) (post-admit comorbidity) is excluded from the numerator.

  - An abstract with *Other streptococcal sepsis* (ICD-10-CA: A40.8) coded as type (1) (pre-admit comorbidity) and *Septic shock* (ICD-10-CA: R57.2) coded as type (2) (post-admit comorbidity) is excluded from the numerator.

How is the risk-adjusted rate calculated for this indicator?

2 logistic regression models built separately for children (younger than 18 years) and adults (18 years and older) are used to calculate the expected number of discharges with an in-hospital sepsis event for each hospital. This calculation takes into account factors that may affect the likelihood of developing sepsis: age, sex, modified Charlson score group, admission category (elective versus urgent), immunocompromised states and surgical versus medical patients. (For complete technical note details, please see the Indicator Library.)

The risk-adjusted in-hospital sepsis rate is calculated by dividing the observed number of discharges with an in-hospital sepsis event in each hospital by the expected number of discharges with an in-hospital sepsis event in the hospital and multiplying by the Canadian average in-hospital sepsis rate. This rate is expressed per 1,000 hospital discharges.

How reliable is the data being used to calculate the indicator?

CIHI engages in various data quality improvement initiatives to ensure the accuracy of our indicators. Standard processes include establishing coding and abstracting standards, automated edits and ongoing education for hospital staff. Despite the implementation of national coding standards, there may be variations in charting and coding practices across the country that could affect the results.

In Canada, specific coding standards for sepsis have been developed since 2001, including the following:

- Assigning a code for sepsis only when the physician has documented the diagnosis. It cannot be assumed nor ruled out on the basis of laboratory values alone.

- Sometimes physicians use the term "sepsis" to describe a localized infection; therefore, coders are instructed to carefully assign the appropriate code. When the term "sepsis" is used to mean a localized infection, coders are guided to search for the lead term "infection" rather than "sepsis."

More information can be found in *Canadian Coding Standards for Version 2012 ICD-10-CA and CCI*.

Interpretation

How can I use the indicator?

The indicator is a risk-adjusted rate of sepsis events identified during hospital stay. The indicator can help hospitals/regions better understand their sepsis rate. A lower risk-adjusted rate for this indicator is desirable. Future publications of this indicator will enable facilities/regions to track changes over time and measure the effectiveness of the strategies or initiatives created to reduce sepsis rates. Additionally, the calculation takes into account patient factors that may affect the likelihood of developing sepsis: age, sex, pre-existing conditions (comorbidity score and immunocompromised state), admission status and surgical/medical patients.

What can hospitals do to reduce in-hospital sepsis rates?

Sepsis is a serious complication of infections. Therefore, prevention of infection is the first and foremost step. In patients with infections, timely and appropriate treatment will reduce the risk of progression to sepsis. There are general best practice guidelines for prevention and control of health care–associated infections, as well as guidelines focusing on prevention of specific infections that are highly associated with sepsis, such as central line infections and surgical site infections. There are also best practice recommendations available on the prevention of sepsis in specific groups of patients, such as cancer patients and those with immunocompromised states. Links to some best practice guidelines are available at the end of this document.

What should I consider when interpreting a risk-adjusted in-hospital sepsis rate?

Due to the limitations of administrative data, there are some specific factors we cannot account for. First, sepsis events can be due to either community- or hospital-acquired infections; the in-hospital sepsis indicator does not necessarily capture hospital-acquired infections only but focuses on the sepsis events that are identified after hospital admission. To account for this, we selected sepsis events identified as a post-admit condition and excluded hospital stays shorter than 2 days. However, information regarding timing of the diagnosis is not available in the administrative data; therefore, the exact origin of infections that led to sepsis and the exact timing of sepsis cannot be established.

Second, adjustment for all potential risk factors and hospital characteristics is impossible; therefore, the results of this indicator alone should not be used to draw conclusions about a hospital's general performance. It is important to consider different aspects as well as contextual information, such as hospital and community characteristics. However, they can be viewed as a starting point for tracking progress over time. To further ensure meaningful comparisons, peer groups and contextual facility and community profile information have been provided to help identify hospital peers.

Appendices

Best practice guidelines for prevention and control of infections and sepsis

Canadian Patient Safety Institute (CPSI)

Infection Prevention and Control (IPAC)

Prevent Central Line Infections

Sepsis: Prevention, Early Identification and Response — Getting Started Kit Components

Surgical Site Infection (SSI)

Ventilator-Associated Pneumonia (VAP)

Centers for Disease Control and Prevention (CDC)

Guidelines for the Prevention of Intravascular Catheter–Related Infections

National Health Service (NHS)

Guidelines for the Prevention of Sepsis in Asplenic Patients

National Institute for Health and Care Excellence (NICE)

Healthcare-Associated Infections: Prevention and Control in Primary and Community Care

Neutropenic Sepsis: Prevention and Management of Neutropenic Sepsis in Cancer Patients

NHS/Royal College of Obstetricians and Gynaecologists (RCOG)

Bacterial Sepsis in Pregnancy