Indicator Library

General Methodology Notes — Clinical Indicators

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Table of contents

1 Purpose of the general methodology notes

The purpose of these notes is to give users the methodological details behind the clinical health system performance (HSP) indicators so they can better understand the results of these measures.

2 Data sources

Hospitals in all jurisdictions (except Quebec) submit acute care and day procedure data to the Discharge Abstract Database (DAD) and/or National Ambulatory Care Reporting System (NACRS) at the Canadian Institute for Health Information (CIHI). Hospitals in Quebec submit data to Maintenance et Exploitation des Données pour l'Étude de la Clientèle Hospitalière (MED-ÉCHO); MED-ÉCHO data is then submitted to CIHI, which integrates it into the Hospital Morbidity Database (HMDB). Please note that prior to 2010–2011, Alberta's day procedure data was submitted to the Alberta Ambulatory Care Reporting System (AACRS) and then provided to CIHI by Alberta Health and Wellness. All hospitalizations in designated adult mental health beds in Ontario are submitted to the Ontario Mental Health Reporting System (OMHRS); also submitted to OMHRS are some hospitalizations in youth inpatient beds and in selected facilities in Manitoba and Newfoundland and Labrador.

For the indicators 30-Day Readmission for Mental Health and Substance Use (MHSU) and Repeat Hospital Stays for MHSU, the population of interest includes discharges from both general hospitals and free-standing psychiatric hospitals (as identified by CIHI). The indicator Hospitalizations Entirely Caused by Alcohol includes discharges from free-standing psychiatric hospitals (in addition to discharges from general hospitals and day surgery clinics). For the DAD, these include all institutions identified as analytical institution type 5; for hospitalization data from Quebec (HMDB), these include all "centres hospitaliers de soins psychiatriques." Specialized acute services can be provided in general hospitals or psychiatric hospitals, and service delivery may differ slightly across jurisdictions. Therefore, interjurisdictional comparisons should be done with caution.

OMHRS data submitted up to August of the next fiscal year is included in MHSU indicator calculations.

3 Health region assignment

- For indicators based on place of residence, to determine what health region a patient belongs to, a patient's postal code at the time of hospitalization is first mapped to census geography using the most up-to-date Statistics Canada's Postal Code Conversion File at the time of indicator calculation; next, it's mapped to a health region using another Statistics Canada product, *Health Regions: Boundaries and Correspondence With Census Geography*.
- Health region–level analyses do not include records with invalid, missing or partial postal codes.

4 Population estimates

- Population estimates are used as denominators for all population-based indicators (expressed as rates per 100,000 population or 10,000 population).
- Population estimates for health regions are preliminary post-censal estimates for July 1 of the corresponding data year. These are based on the latest census, adjusted for census net under-coverage, and on administrative sources on births, deaths and migration. Population estimates by health region are derived from the sub-provincial population estimates, which are produced using the components method by the Demography Division at Statistics Canada, except for the British Columbia estimates and the Quebec estimates. Population estimates for health regions in B.C. were provided by BC Stats and those for Quebec by the Institut de la statistique du Québec. Population estimates are based on the boundaries in effect at the time of indicator calculation.
- Population counts by neighbourhood income quintile were estimated based on dissemination area (DA)–level population counts from the 2006, 2011 and 2016 censuses. Detailed methodology is available upon request. Due to missing income information for about 3% of DAs in each of the census years, the population estimates used for income quintile analysis are usually smaller than the provincial population estimates provided by Statistics Canada.

5 Hospitalization data and rates

- For indicators based on place of residence, data is reported based on the region of the patient's residence, not region of hospitalization. Consequently, these figures reflect the hospitalization experience of residents of the region wherever they are treated, including out of province, as opposed to the comprehensive activity of the region's hospitals (that will also treat people from outside of the region).
- For indicators based on place of service (where the patient was treated), data is reported based on the administrative region of the facility (e.g., region of hospitalization).
- Rates are standardized or risk-adjusted wherever possible to facilitate comparability across provinces/regions/facilities and over time.
- As of 2014–2015, the 2011 Canadian reference population is used to age-standardize indicators. The 2011 population estimates are as follows:

Age (in years)	Age group	Standard population, Canada, July 1, 2011
0–4	1	1,899,064
5–9	2	1,810,433
10–14	3	1,918,164
15–19	4	2,238,952
20–24	5	2,354,354
25–29	6	2,369,841
30–34	7	2,327,955
35–39	8	2,273,087
40–44	9	2,385,918
45–49	10	2,719,909
50–54	11	2,691,260
55–59	12	2,353,090
60–64	13	2,050,443
65–69	14	1,532,940
70–74	15	1,153,822
75–79	16	919,338
80–84	17	701,140
85–89	18	426,739
90+	19	216,331

Source
Statistics Canada, Demography Division.

- The following 2011 population was used to age-standardize indicators that use age 18 as the cut-off.

Age (in years)	Age group	Standard population, Canada, July 1, 2011
0–4	1	1,899,064
5–9	2	1,810,433
10–14	3	1,918,164
15–17	4	1,313,471
18–24	5	3,279,835
25–29	6	2,369,841
30–34	7	2,327,955
35–39	8	2,273,087
40–44	9	2,385,918
45–49	10	2,719,909
50–54	11	2,691,260
55–59	12	2,353,090
60–64	13	2,050,443
65–69	14	1,532,940
70–74	15	1,153,822
75–79	16	919,338
80–84	17	701,140
85–89	18	426,739
90+	19	216,331

Source
Statistics Canada, Demography Division.

- To ensure interprovincial comparability of indicators, diagnosis codes representing diabetes without complications (E10.9, E11.9, E13.9, E14.9) were recoded to diabetes with complications as per the Canadian coding standards on applicable records for Quebec HMDB data. Details are available upon request.
- Wherever information is available, procedures that have been performed out of hospital and procedures abandoned after onset are excluded from the calculations.

6 Identifying acute care and day procedure data

Potential acute care and day procedure records can be identified using the criteria shown in the tables below.

Table 1A Potential acute care and day procedure records — DAD data

Criteria	Specifications	Codes
Include	All acute care and day procedure records	Facility Type Code* = 1 (acute care) or A (day surgery)
Exclude	Stillbirths and cadaveric donors	Admission Category Code = S or R
	Potential duplicate records (prior to 2013–2014)	Prior to 2013–2014, duplicate records are excluded if they match on the following data elements: Facility Province, Institution Number, Health Card Number, Birth Date, Gender, Patient Postal Code, Admission Date, Admission Time, Weight, Discharge Date, Discharge Time, Most Responsible Diagnosis and Principal Intervention. Beginning in 2013–2014, duplicate records are no longer removed.

Note

* Facility Type Code is a CIHI variable that identifies the level of care of an institution (e.g., acute care, day surgery, subacute).

Table 1B Potential day procedure records — NACRS data

Criteria	Specifications	Codes
Include	Day surgery records	Ambulatory Care Group Code = DS Prior to the 2010–2011 data year, day surgery records were identified using functional centre codes; please see Table 1D: Day surgery MIS functional centre codes below
	Cardiac catheterization labs in Ontario, Alberta and Nova Scotia	Ambulatory Care Group Code = CL and Ambulatory Type Code = 31
	Scheduled emergency department (ED) visits	(Ambulatory Care Group Code = ED **and** ED_VISIT_INDICATOR = 0)
	Cases with specific procedures of interest that were performed in non-ED centres and that do not fit into any of the above criteria	Hysterectomy: CCI code 1.RM.89.^^, 1.RM.91.^^ or 1.RM.87.^^ with extent attribute = SU Prostatectomy: CCI code 1.QT.59.^^ or 1.QT.87.^^ Percutaneous coronary intervention (PCI): CCI code 1.IJ.50.^^, 1.IJ.57.GQ.^^, 1.IJ.54.GQ-AZ, 1.IJ.57.GT or 1.IJ.57.GU Coronary artery bypass graft (CABG): CCI code 1.IJ.76.^^ Hip replacement: CCI code 1.VA.53.^^ or 1.SQ.53.^^ Knee replacement: CCI code 1.VG.53.^^ or 1.VP.53.^^ Angiography: CCI code 3.IP.10.VX Cholecystectomy: CCI code 1.OD.89.^^ Labour and delivery: CCI code 5.MD.50.^^, 5.MD.51.^^, 5.MD.52.^^, 5.MD.53.^^, 5.MD.54.^^, 5.MD.55.^^, 5.MD.56.^^ or 5.MD.57.^^
Exclude	Potential duplicate records (prior to 2013–2014)	Prior to 2011–2012, duplicate records are excluded if they match on the following data elements: Chart Number, Health Card Number, Date of Registration and Time of Registration. For records from Alberta, additional variables were used to identify potential duplicates: Diagnosis Code, Procedure Code, MIS Functional Centre Code and Provider Number. In 2011–2012 and 2012–2013, a common list of variables was used to identify duplicates in NACRS: Chart Number, Health Card Number, Date of Registration, Time of Registration, Facility Ambulatory Care Number, Gender, Visit Disposition, Main Problem, Main Intervention and MIS Functional Centre Code. Beginning in 2013–2014, duplicate records are no longer removed.
	Main provider is not a physician	Provider_Type = M and Provider_Service_Code = (00000–01003, 01012, 01013)

Table 1C Potential acute care and day procedure records — HMDB data

Criteria	Specifications	Codes
Include	All acute and day surgery records for Quebec only	Facility Type Code* = 1 (acute care) or A (day surgery)
Exclude	Stillbirths and cadaveric donors	Admission Category Code = S or R
	Potential duplicate records (prior to 2013–2014)	Prior to 2013–2014, duplicate records are excluded if they match on the following data elements: Facility Province, Institution Number, Health Card Number, Gender, Admission Date, Admission Time, Weight, Discharge Date, Discharge Time and Most Responsible Diagnosis. Beginning in 2013–2014, duplicate records are no longer removed.

Notes

* Facility Type Code is a CIHI variable that identifies the level of care of an institution (e.g., acute care, day surgery, subacute). Quebec does not submit birthdate, patient postal code or principal intervention data.

Table 1D Day surgery MIS functional centre codes

Fiscal year	Ontario	Nova Scotia
2007–2008	7*260**, 7*262, 7*265**, 7*34020, 7*34025**, 7*34055 (* = 1, 2 or 3; ** = series)	712600000, 722600000, 712602000, 712602500, 712603000, 712604000, 712604500, 712606000, 712606500, 712607000, 712609900, 713402000, 713402500, 713402520, 713403500, 713403700, 713405500
2008–2009	7*260**, 7*262, 7*265**, 7*34025**, 7*34055 (* = 1, 2 or 3; ** = series)	712600000, 722600000, 712602000, 712602500, 712603000, 712604000, 712604500, 712606000, 712606500, 712607000, 712609900, 713402000, 713402500, 713402520, 713403500, 713403700, 713405500
2009–2010	7*260**, 7*262, 7*265, 7*34055, 7*360, 7*362, 7*365, 7*369 (* = 1, 2 or 3; ** = series)	712600000, 722600000, 712602000, 712602500, 712603000, 712604000, 712604500, 712606000, 712606500, 712607000, 712609900, 712650000, 712652000, 712654000, 712656000, 713403500, 713403700, 713405500, 713600000, 713620000, 713650000, 713670000, 713671000, 713672000, 713690000
All jurisdictions submitting day surgery data to NACRS		
2010–2011 onward	Ambulatory Care Group Code = DS (Day Surgery), consisting of the following MIS functional centre codes: 7*2600000, 7*2602000, 7*2602500, 7*2604000, 7*2604500, 7*2606000, 7*2606500, 7*2607000, 7*2620000, 7*2650000, 7*2652000, 7*2654000, 7*2656000, 7*3600000, 7*3620000, 7*3650000, 7*3670000, 7*3690000, 7*3960000, 7*3405500, 7*2603000, 7*2960000	

7 Grouping methodologies

Acute care inpatient records are grouped to a major clinical category (MCC) as well as to a specific case mix group (CMG). CMGs and MCCs are then used to group patients with similar clinical characteristics. Specifically, they are used in the calculation of some indicators, such as In-Hospital Sepsis, Hospital Deaths Following Major Surgery and the Readmission indicators (see sections 15 and 16). For further details on the acute inpatient grouping methodology, please visit the CMG+ web page.

8 Record linkage — Linking cases across hospitals and building episodes of care

Record linkage

Starting in 2016, a new patient linkage standard was developed and implemented at CIHI. The new standard uses encrypted health card number (HCN) and the HCN-issuing province for record linkage (linkage keys). Prior to this, encrypted HCN and birthdate were used as linkage keys. The impact of changing the patient linkage methodology is minimal. All records with valid linkage keys are eligible for patient linkage.

The linkage methodology allows for linkage across Canada, with the exception of Quebec and Manitoba due to the submission format of their HCNs. For data submitted by Manitoba, we are unable to link Manitoba residents who are admitted/transferred in and out of Manitoba. For data submitted by Quebec, we are unable to link patients who are admitted/transferred in and out of Quebec.

Episodes of care

The unit of analysis for most of the indicators is an episode of care. An episode of care refers to all contiguous inpatient hospitalizations and day procedure visits. This avoids analyzing transfers as 2 separate hospitalizations. To construct an episode of care, a transfer is assumed to have occurred if either of the following conditions is met:

- Admission to an acute care institution or day surgery facility occurs less than 7 hours after discharge from another acute care institution or day surgery facility, regardless of whether either institution codes the transfer; or
- Admission to an acute care institution or day surgery facility occurs between 7 and 12 hours after discharge from another acute care institution or day surgery facility and at least one of the institutions codes the transfer.

Due to the absence of time of admission/discharge variables in the OMHRS database, episode-building involving these mental health records can be linked using only date of admission/discharge variables. A transfer is assumed if admission to an institution occurs within the same date as discharge from another institution (including overlapping hospitalizations on the same day).

All records with valid linkage keys, admission dates/times and discharge dates/times from the DAD, as well as day surgery data from NACRS, are linked across provinces. An acute care or day procedure record from one facility is linked to a subsequent acute care or day procedure record in any facility by matching the linkage keys.

As we are unable to link Manitoba residents who are admitted/transferred in and out of Manitoba, and patients who are admitted/transferred in and out of Quebec, results from regions and hospitals that routinely transfer patients to or from these provinces may be affected. For example, indicator results for hospitals that routinely transfer patients to Manitoba or Quebec for cardiac procedures may be affected. This issue has specifically been identified for the Edmundston Zone and Campbellton Zone in New Brunswick, as patients from these 2 zones are often transferred to Quebec for cardiac procedures.

9 Peer group methodology

The purpose of assigning hospitals to a peer group is to facilitate standard comparisons by categorizing acute care hospitals that have similar structural and patient characteristics.

The **standard peer groups** were developed based on literature reviews and consultations with internal and external experts. Hospitals were assigned to 1 of 4 standard peer groups: T (Teaching), H1 (Community — Large), H2 (Community — Medium) and H3 (Community — Small).

Hospitals were designated as teaching if they

- Had confirmed teaching status from the provincial ministry; or
- Were identified as teaching in the provincial ministry's submission to the Canadian MIS Database.

Based on 2015–2016 to 2017–2018 data, non-teaching hospitals are allocated to the large, medium or small community hospital peer group based on their volumes (using inpatient cases, total weighted cases and inpatient days). Hospitals are categorized as H1 (large) if they meet 2 of the following 3 criteria:

- More than 8,000 inpatient cases
- More than 10,000 weighted cases
- More than 50,000 inpatient days

Hospitals that do not meet the above criteria were classified as H2 (medium) or H3 (small) depending on the hospital's total weighted cases (H2 — 2,000 weighted cases or more, H3 — fewer than 2,000 weighted cases). Borderline cases were reviewed and reassigned based on averages across multiple years. The hospital-level peer group for multi-site hospitals is assigned based on the hierarchy of the site-level peer groups. The hierarchical order is T, H1, H2 and then H3.

10 Calculation of Canada and hospital peer group rates

To facilitate the timely release of indicator results, a blended average methodology is used to calculate the overall Canada rate and hospital peer group rates for indicators that include MED-ÉCHO data from Quebec. In this methodology, records from the current year from all jurisdictions outside of Quebec and records from the previous year from Quebec are blended to calculate Canada and hospital peer group rates.

The Canada and hospital peer group blended rates are used for statistical testing, comparisons and reporting. Additionally, the blended Canada average is used in the calculation of risk-adjusted rates (see Section 11).

This methodology was introduced because CIHI receives MED-ÉCHO data from Quebec after the closure of the DAD. By using this methodology, CIHI can calculate and release results for DAD-submitting organizations in a more timely manner, since results for indicator and statistical testing of above/below average for DAD-submitting organizations will not change with the inclusion of Quebec data at a later date.

However, this blended average methodology is not applicable to the following MHSU indicators because the same year of data from all jurisdictions is used to calculate the Canada rate:

- 30-Day Readmission for Mental Health and Substance Use
- Repeat Hospital Stays for Mental Health and Substance Use

11 Risk adjustment

When comparing outcomes across various organizations, it is important to account for differences in patient characteristics that may vary among jurisdictions and hospitals; without adjustment, data comparisons can be skewed by differences in patient populations. Risk adjustment is a method used to control for patient characteristics and other risk factors that may affect health care outcomes and improve comparability of results.

Statistical regression modelling, an indirect method of standardization, was used to perform risk adjustment. Risk factors that were controlled for include age, sex and selected pre-admit comorbid diagnoses that were applicable to the indicator. The selected risk factors were identified based on a literature review, clinical evidence and expert group consultations using the principles of appropriateness, viability (i.e., sufficient number of events) and data availability. Risk factors must be listed as significant pre-admit conditions on the patient's abstract for them to be identified for risk adjustment. For indicators relating to readmission after certain medical conditions (e.g., Readmission After Acute Myocardial Infarction, Overall Readmission), diagnoses were flagged as risk factors if they were recorded as pre-admit conditions on any of the records in the same episode of care. For all other indicators, risk factors were flagged if conditions were recorded as pre-admit diagnoses on the record where the outcome/denominator was abstracted.

Coefficients derived from logistic regression models were used to calculate the probability of an outcome for each denominator case; these were then summed for each hospital organization (or for other reporting levels such as regions, provinces and peer groups) to calculate the expected number of cases of each outcome. The risk-adjusted rate was calculated by dividing the observed number of cases by the expected number of cases and then multiplying that result by the Canada average, except for the Hospital Deaths indicator, where 100 is considered the Canada average.

The formula is as follows:

> Risk-adjusted rate = Observed cases ÷ Expected cases × Canada average
>
> Where
>
> **Observed cases** = the number of observed events (or numerator cases, such as actual number of deaths)
>
> **Expected cases** = the number of expected events, adjusted for the distribution of risk factors by hospital peer groups (regions, provinces, etc.). Coefficients are derived from regression models to obtain the expected number of cases.

> **Canada average** = the standard population rate, or the Canadian average rate for all provinces and territories (total number of numerator cases nationally divided by the total number of denominator cases nationally, multiplied by 100 if the indicator is expressed as a rate per 100, or by another pre-defined unit such as 1,000 discharges or 10,000 patient days). To facilitate the timely release of indicator results, for indicators that include data from Quebec, risk-adjusted rates are calculated using a ***blended* Canada average**. Please refer to Section 10 for further details.

In addition, 95% confidence interval (CI) limits for the risk-adjusted rates were calculated to aid interpretation and comparisons. CIs are used to establish whether the indicator result is statistically different from the average. The width of the CI illustrates the degree of variability associated with the rate. Indicator values are estimated to be accurate within the upper and lower CI 19 times out of 20 (95% CI). Risk-adjusted rates with CIs that do not contain the Canada or peer group result can be considered statistically different. Further details on the calculation of CIs are available upon request.

It is important to note that the expected performance level of an organization in this indirect method of standardization is based on how all organizations across Canada perform, because the number of expected cases is calculated based on regression models fitted on all cases from all organizations. Furthermore, risk-adjustment modelling cannot entirely eliminate differences in patient characteristics among hospitals, because not all risk factors are adjusted for; if left unadjusted for (due to reasons such as viability), hospitals with the sickest patients or that treat rare or highly specialized groups of patients could still score poorly.

Information on model specifications (coefficients and p-values) and ICD-10-CA codes used to flag risk factors can be found in the Model Specifications document. Also, please see the Supporting resources section of the Indicator library web pages for more information about diagnosis types that were used to define risk factors.

12 Defining neighbourhood income quintile

CIHI uses neighbourhood income quintiles for measuring and reporting income-related inequality in the population.

Assigning patients to neighbourhood income quintiles

- Each patient was assigned to a neighbourhood income quintile using Statistics Canada's Postal Code Conversion File Plus (PCCF+).[1] This software links the 6-character postal codes to the standard Canadian census geographic areas (such as DAs, census tracts and census subdivisions). By linking postal codes to the census geography, the file facilitates extraction of the relevant census information (e.g., income) for each geographic area.
- The DA is the smallest geographical unit available for analysis in the Canadian Census, with a targeted population size of 400 to 700 persons.[2] Using the most up-to-date PCCF+ at the time of indicator calculation, the postal code of the patient's place of residence at the time of hospitalization was mapped to the corresponding Census DA, and the neighbourhood income quintile of that DA was assigned to the patient.
- In the PCCF+, for postal codes that map to more than one DA, probabilistic assignment based on population size is used, meaning that the same postal code can be mapped to a different DA if the program is run more than once. However, a SAS technique can be employed to ensure that each postal code record is always assigned to the same DA, if needed.

Construction of income quintiles for dissemination areas

- The neighbourhood income quintiles available in the PCCF+ were constructed according to the methods developed at Statistics Canada.[3] A short description of the method is provided below.
- Neighbourhood income quintiles were based on the average income per single-person equivalent in a DA obtained from the census. This measure uses the person weights implicit in the Statistics Canada low-income cut-offs to derive "single-person equivalent" multipliers for each household size.[1] For example, a single-person household received a multiplier of 1.0, a 2-person household received a multiplier of 1.24 and a 3-person household received a multiplier of 1.53. To calculate average income per single-person equivalent for each

DA, total income of the dissemination area was divided by the total number of single-person equivalents. Income quintile for DAs with a household population of less than 250 was imputed based on the neighbouring DAs (where possible), because census data on income for these DAs was suppressed.

- Next, quintiles of population by neighbourhood income were constructed separately for each census metropolitan area, census agglomeration or residual area within each province. DAs within each such area were ranked from the lowest average income per single-person equivalent to the highest, and DAs were assigned to 5 groups, such that each group contained approximately one-fifth of the total non-institutional population of each area.
- The quintile data was then pooled across the areas. Quintiles were constructed within each area before aggregating to the national or provincial level to minimize the potential effect of the differences in income, housing and other living costs across different areas in the country.
- Quintile 1 refers to the least-affluent neighbourhoods, while quintile 5 refers to the most affluent neighbourhoods.

Limitations

- Neighbourhood income quintiles derived from linking postal codes to the census are less accurate in rural areas because rural postal codes cover larger geographical areas. Another limitation is that the measure excludes people living in long-term care facilities because income data from the Canadian census is available for non-institutional residents only. As a result, not all people can be included in the rates by neighbourhood income quintile.

13 Defining urban and rural/remote

CIHI uses urban and rural/remote place of residence as the standard approach for measuring inequalities related to geographic location.

Assigning patients to urban and rural/remote locations

Statistics Canada's Statistical Area Classification type (SACtype) is used to define *urban* and *rural/remote* locations in our reporting products. SACtype is assigned based on postal codes using Statistics Canada's Postal Code Conversion File Plus (PCCF+). SACtype values 1 to 3 are defined as urban and values 4 to 8 are defined as rural/remote.

SACtype identifies the type of Statistical Area Classification in which a census subdivision (CSD) is located, specifically whether the CSD is part of a census metropolitan area (CMA), census agglomeration (CA) or census metropolitan influenced zone (MIZ), where the degree of influence for the MIZ is determined based on commuting flows. See the following table for details.

Statistical Area Classification (SAC)			SAC type	Urban or rural/remote
Census metropolitan area (CMA) or census agglomeration (CA) *1 or more adjacent municipalities centred around a core*	CMA	At least 100,000 people, including 50,000 in the core	1	Urban
	CA with at least one census tract	At least 50,000 people in the core	2	
	CA, no census tracts	10,000 to 50,000 people in the core	3	
Metropolitan influenced zone (MIZ) *Percentage of employed residents commuting to a CMA/CA*	Strong MIZ	At least 30% commute	4	Rural/remote
	Moderate MIZ	5–30% commute	5	
	Weak MIZ	More than 0% and less than 5% commute	6	
	No MIZ	0% commute	7	
Territories outside CMA/CA	Municipalities in the territories outside of the Yellowknife and Whitehorse CAs		8	

14 Health disparity measures

Selected indicators are reported by neighbourhood income quintiles and by urban and rural/remote location. For these indicators, the following 2 disparity measures are calculated:

Disparity rate ratio (DRR)

Disparity rate ratio provides a summary measure of the magnitude of the disparity for a health indicator in a jurisdiction.

For income-related inequality, DRR is the ratio of a health indicator rate for the least-affluent neighbourhood income quintile (Q1) to the rate for the most-affluent neighbourhood income quintile (Q5). For inequalities related to geographic location, DDR is the ratio of a health indicator rate for a rural/remote location to the rate for an urban location.

DRR should be evaluated together with other measures, such as the indicator rate for each neighbourhood income quintile or the geographic location and the potential rate reduction (see below). The 95% CI is provided to assist interpretation. When the 95% CI does not contain a value of 1, DRR indicates a statistically significant disparity between the compared rates.

Potential rate reduction (PRR)

This is the reduction in a health indicator rate that would occur in the hypothetical scenario that each neighbourhood income group experienced the rate of the most-affluent neighbourhood income quintile (Q5), expressed as a percentage. In the context of geographic location, it refers to the reduction in a health indicator rate if rural/remote residents experienced the rate of urban residents. This measure is based on the concept of the excess morbidity or mortality that could be prevented and provides a summary measure of the overall effect of health disparities on a health indicator. It should be evaluated together with other measures, such as the indicator rate for each neighbourhood income quintile or the geographic location and DRR (see above). The 95% CI is provided to assist interpretation. When the 95% CI does not contain a value of 0, PRR indicates a statistically significant potential reduction in the overall indicator rate.

PRR based on neighbourhood income quintile is calculated as follows:

$$\text{PRR} = \frac{\sum_{i=1}^{5} P_i \left(\frac{\text{Rate}_i}{\text{Rate}_5} - 1\right)}{1 + \sum_{i=1}^{5} P_i \left(\frac{\text{Rate}_i}{\text{Rate}_5} - 1\right)} \times 100\%$$

Where Rate*i* and P*i* are the rate and the proportion of the population in each of the 5 income quintiles, respectively.

PRR based on urban and rural/remote location is calculated as follows:

$$\text{PRR} = \frac{\text{P}_{rural/remote}\left(\frac{\text{Rate}_{rural/remote}}{\text{Rate}_{urban}} - 1\right)}{1 + \text{P}_{rural/remote}\left(\frac{\text{Rate}_{rural/remote}}{\text{Rate}_{urban}} - 1\right)} \times 100$$

Where $\text{Rate}_{\text{rural/remote}}$ and $\text{Rate}_{\text{urban}}$ are the respective rates for rural/remote and urban locations, $\text{P}_{\text{rural/remote}}$ is the proportion of the population in the rural/remote location.

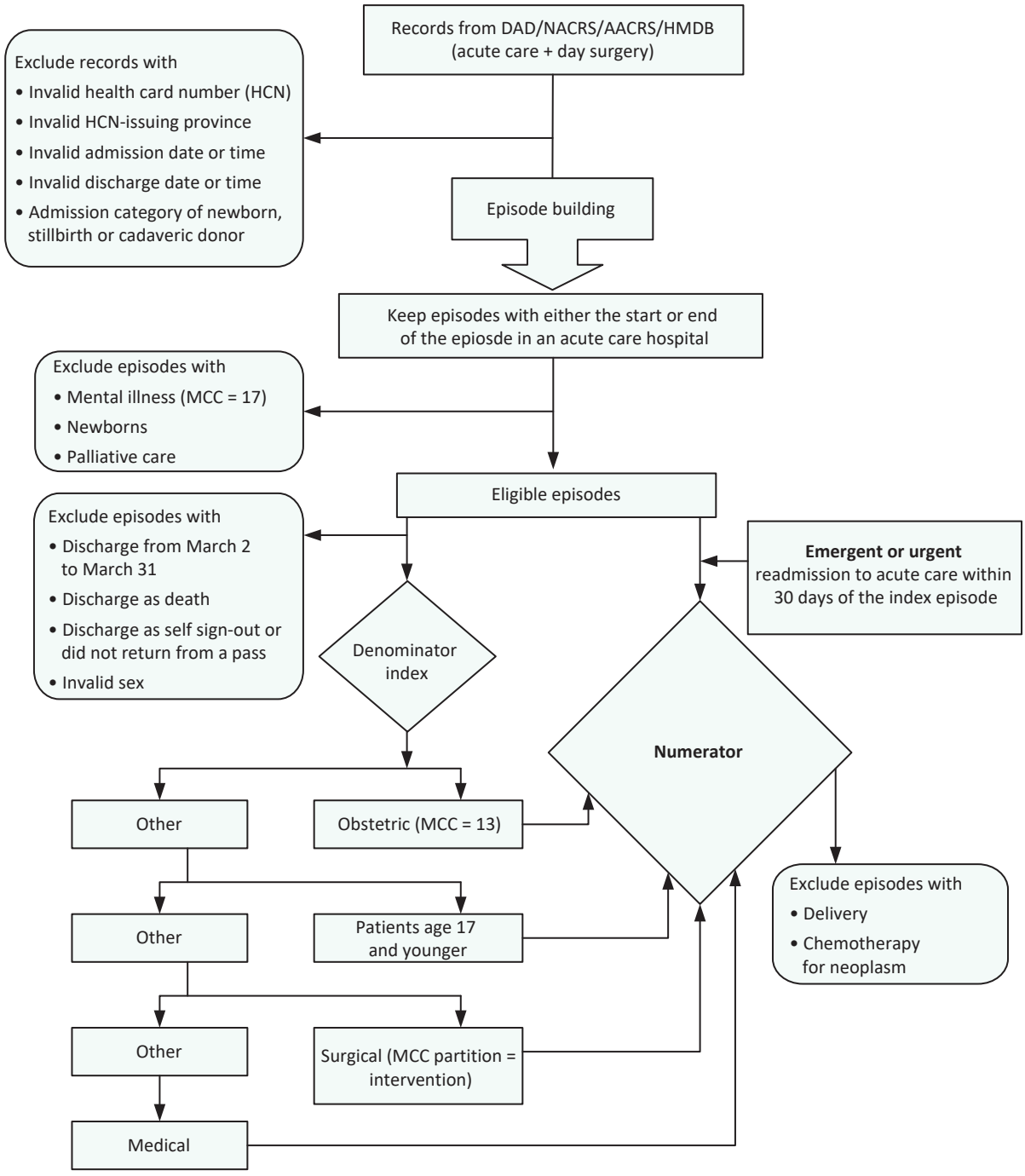
15 Major surgery patient group list — CMG+ codes

The following CMGs include only CMG+ codes linked to major surgical procedures:

CMG+ 2022

004, 005, 006, 007, 008, 009, 010, 012, 013, 015, 071, 073, 074, 078, 082, 083, 110, 113, 114, 121, 160, 189, 190, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 180, 181, 182, 188, 220, 221, 222, 223, 224, 225, 227, 233, 270, 271, 274, 289, 290, 300, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 351, 352, 327, 328, 330, 331, 336, 338, 347, 349, 350, 383, 386, 420, 421, 422, 423, 424, 426, 450, 451, 452, 453, 454, 457, 462, 463, 500, 501, 502, 503, 504, 533, 612, 618, 725, 726, 727, 729, 730, 731, 733, 736, 738, 740, 752

16 Flowchart: 30-day obstetric/ pediatric/surgical/ medical readmission



17 The Charlson Index

The Charlson Index is an overall comorbidity score. Evidence shows it to be highly associated with mortality, and it has been widely used in clinical research on mortality. Based on Quan's methodology,[4] using pre-admission comorbidities recorded on the abstract, the comorbid conditions below are used to calculate the Charlson Index score. Conditions within each group are counted only once (e.g., if I43 and I50 appear on the abstract, the score will be 2). If conditions from different groups are present on the abstract, their weights will be summed (e.g., if I50 and F01 are present on the abstract, the score will be 4).[5]

Comorbid conditions	ICD-10-CA codes†	Weight
Congestive heart failure	I099, I255, I420, I425, I426, I427, I428, I429, I43*, I50, P290	2
Dementia	F01, F02*, F03, F051, G30, G311	2
Chronic pulmonary disease	I278, I279, J40, J41, J42, J43, J44, J45, J47, J60, J61, J62, J63, J64, J65, J66, J67, J684, J701, J703	1
Rheumatologic diseases	M05, M06, M315, M32, M33, M34, M351, M353, M360*	1
Mild liver disease	B18, K700, K701, K702, K703, K709, K713, K714, K715, K717, K73, K74, K760, K762, K763, K764, K768, K769	2
Diabetes with chronic complications	E102, E103, E104, E105, E107, E112, E113, E114, E115, E117, E132, E133, E134, E135, E137, E142, E143, E144, E145, E147	1
Hemiplegia or paraplegia	G041, G114, G801, G802, G81, G82, G830, G831, G832, G833, G834, G839	2
Renal disease	N032, N033, N034, N035, N036, N037, N052, N053, N054, N055, N056, N057, N18, N19, N250, Z490, Z491, Z492	1
Moderate or severe liver disease	I850, I859, I864, K704, K711, K721, K729, K765, K766, K767	4
AIDS/HIV	B24, O987	4
Any malignancy, including lymphoma and leukemia	C0, C1, C20, C21, C22, C23, C24, C25, C26, C30, C31, C32, C33, C34, C37, C38, C39, C40, C41, C43, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C6, C70, C71, C72, C73, C74, C75, C76, C81, C82, C83, C84, C85, C88, C90, C91, C92, C93, C94, C95, C96, C97	2
Metastatic solid tumour	C77, C78, C79, C80	6

Notes

† Diagnosis codes starting with the 3- or 4-digit codes are listed in the table.

For provinces other than Quebec, only diagnosis types (1), (W), (X) and (Y) are used to calculate the Charlson Index score, with the following exceptions:

- Diagnosis type (3) is also used for all diabetes codes.
- Diagnosis type (3) is also used for all codes included in the "any malignancy" and "metastatic solid tumour" groups.
- Only diagnosis type (3) is used for asterisk (*) codes.

For Quebec, only diagnosis types (C), (W), (X) and (Y) are used to calculate the Charlson Index score.

Due to differences in data collection, it is not possible to distinguish comorbidities (DAD diagnosis type (1)) from secondary diagnoses (DAD diagnosis type (3)) in Quebec data. As a result, Quebec patients in the HMDB will get higher probabilities in the logistic regression model and the results for Quebec hospitals will not be comparable with those for the rest of the country. The distribution of the Charlson Index score was shifted for Quebec patients so that patients with higher Charlson Index scores are included in lower Charlson Index score groups.

The distribution is as follows:

Charlson group	Charlson scores in the groups, DAD	Charlson scores in the groups, HMDB Quebec
0	0	0–1
1	1–2	2–4
2	3+	5+

For the In-Hospital Sepsis indicator, a modified version of the Charlson Index is used, as some of the diagnosis codes overlap with other risk factors in the risk-adjustment model. Specifically, N18, Z49, B24 and O98.7 have been removed from the Charlson Index risk factor, as these codes are adjusted for in the Immunocompromised States risk factor. Additionally, diagnosis type (M) is used for all diagnosis codes, and diagnosis type (3) is used for cancer and metastatic carcinoma codes. Scores from Quebec are re-grouped the same way as noted above. Modification is also done for the Hospital Standardized Mortality Ratio indicator; please refer to the *Hospital Standardized Mortality Ratio Methodology Notes* for details.

Appendix: Text alternative for figures

Text alternative for equations in Section 14 — PRR calculation

PRR based on neighbourhood income quintile equals equation 1 divided by equation 2 and then multiplied by 100%. Equation 1 is the sum of the results for categories *i* = 1 through 5, calculated in the following manner: the proportion of the population for the *i*th category, multiplied by the (rate of the *i*th category divided by the 5th category rate) minus 1. Equation 2 is 1 + equation 1.

PRR based on urban and rural/remote location equals equation 1 divided by equation 2 and then multiplied by 100%. Equation 1 is the proportion of the population at the rural/remote location, multiplied by the (rate of the rural/remote location divided by the rate of the urban location) minus 1. Equation 2 is 1 + equation 1.

Text alternative for image in Section 16 — Flowchart: 30-day obstetric/pediatric/surgical/medical readmission

The readmission indicators measure the rate of all-cause urgent readmission within 30 days of discharge for episodes of care for the following patient groups:

1. Obstetric
2. Pediatric
3. Surgical
4. Medical

Denominator episodes of care are assigned to one of the above mutually exclusive patient groups in the order that they are listed (see also Part B below).

The following steps outline how to assign denominator episodes to a patient group, and how to determine whether a readmission occurred:

Part A: Identify eligible episodes

- Step 1: Start with all acute and day surgery records from the DAD, NACRS and HMDB (as outlined in Section 7 of this document).
- Step 2: Exclude records with the following:
  - Invalid health card number;
  - Invalid province issuing health card number;
  - Invalid admission date or time;
  - Invalid discharge date or time; and
  - Admission category of newborn, stillbirth or cadaveric donor.
- Step 3: Use the remaining records from Step 2 to build episodes of care (as outlined in Section 9 of this document).

- Step 4: Keep episodes where either the start or end of the episode is in an acute care hospital.
- Step 5: Keep episodes from Step 4 and **exclude** the following:
  - Mental illness (MCC = 17) in any record of the episode;
  - Newborns in any record of the episode;
  - Palliative care in any record of the episode;
  - Episodes with discharge between March 2 and March 31; and
  - Episodes with discharge disposition of death, self sign-out or invalid sex.
- The episodes that are left at the end of Step 5 are the **eligible episodes** (i.e., denominator episodes).

Part B: Identify patient group

- Step 1: Assign eligible episodes from Part A to the *Obstetric* patient group if MCC = 13 in any record of the episode.
- Step 2: Of the remaining eligible episodes not assigned in Step 1, assign episodes to the *Patients Age 17 and Younger* group if the patient is age 17 or younger at admission on the last record of the episode.
- Step 3: Of the remaining eligible episodes not assigned in steps 1 and 2, assign episodes to the *Surgical* patient group if the MCC partition = intervention in any record of the episode.
- Step 4: Assign the remaining eligible episodes to the *Medical* patient group.

Part C: Identify denominator episodes with a readmission (numerator)

- Step 1: For each denominator episode, identify the patient's subsequent admission episode to an acute care hospital where the admission date (first record of the episode) is within 30 days of the denominator episode discharge date (if any).
- Step 2: If the condition for Step 1 is met, identify the subsequent admission episode as a readmission (numerator) only if the following conditions apply:
  - First record of the episode is recorded as emergent or urgent.
  - Episode does **not** have any of the following:
    - Obstetric delivery
    - Chemotherapy for neoplasm

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