Indicator Library: General Methodology Notes— Clinical Indicators, March 2015

Health System Performance

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Better data. Better decisions.
Healthier Canadians.

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that enables sound policy and
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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

In 2013–2014, most participating hospitals submitted acute care and day procedure data to CIHI's Discharge Abstract Database (DAD) and National Ambulatory Care Reporting System (NACRS). Hospitals in Quebec submitted 2013–2014 data to MED-ÉCHO; MED-ÉCHO then submitted the data to CIHI and integrated 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 Services.

For the mental health–related indicators (30-day readmission for mental illness [MI], repeat hospitalizations for MI, MI hospitalization, MI patient days and self-injury hospitalization), the population of interest includes discharges from general hospitals. Same-day surgery visits are included if they are part of an inpatient episode of care. Thus all free-standing psychiatric hospitals identified by owners of the database used were not included. For the DAD, these include all institutions identified as analytical institution type 5; for hospitalization data from Quebec (MED-ÉCHO), these include all "centres hospitaliers de soins psychiatriques." A list of psychiatric hospitals in the Ontario Mental Health Reporting System (OMHRS) was provided by the OMHRS program area at CIHI. 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.

For indicators that include data from OMHRS, OHMRS data that is available up until September of the next fiscal year is used. For example, rates for 2011–2012 include OMHRS data submitted to CIHI up until September 2012.

The clinical indicator results are based on data for patients who died, were discharged[i] or signed out during the fiscal year of interest.[ii] Unless otherwise specified, indicator results are based on acute care hospitals for the reference period. Same-day surgery (outpatient) cases are included in several indicators (see indicator definitions for exceptions). Patients admitted to non–acute care hospitals (such as chronic care, psychiatric and rehabilitation facilities) are generally not included in the totals.

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i.   Please note that abstracts from NACRS are based on admissions rather than discharges.

ii.   A fiscal year runs from April 1 to March 31 of the following calendar year. Included in the indicator calculations are patients who died, were discharged or signed out of hospital during the relevant fiscal year.

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 Statistics Canada's Postal Code Conversion File (PCCF June 2013) and then 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.

- Non-Canadian residents are excluded from the rates. They are identified by a mini–postal code relating to one of the U.S. states or by a postal code value indicating out-of-country residents.

4   Neighbourhood Income Quintiles

- Patients were assigned neighbourhood-level income quintiles using the Statistics Canada Postal Code Conversion File Plus (PCCF+, version 6A). By using this program, the postal code of a patient's place of residence at the time of hospitalization was mapped to the smallest geographical unit available for analysis in the 2011 Canadian Census—the dissemination area (DA)—and the corresponding neighbourhood income quintile of that DA was assigned to the patient. See Section 12 for detailed methodology on neighbourhood income quintile assignment.

- Patients from DAs without income information cannot be assigned to a neighbourhood income quintile and therefore cannot be included in disparity measure analyses.

5   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, 2013. These are based on the latest census, adjusted for census net under-coverage and incompletely enumerated Indian reserves, and on administrative sources on births, deaths and migration. Population estimates by health region are derived from the Census Division population estimates, which are produced using the components method and are produced by the Demography Division at Statistics Canada, except for the British Columbia estimates and the Quebec preliminary estimates. Population estimates for health regions in B.C. were provided by BC Stats. Population estimates for health regions in Quebec were derived from census division population estimates provided by the Institut de la statistique du Québec. Population estimates are based on the boundaries in effect as of 2013 (see Statistics Canada, Demography Division, CANSIM Table 109-5335).

- Population counts by neighbourhood income quintile were estimated based on DA-level population counts from the 2006 and 2011 censuses. Detailed methodology is available upon request. Due to missing income information for about 3% of DAs in the 2006 Census, the population estimates used for income quintile analysis are usually smaller than the provincial population estimates provided by Statistics Canada.

6   Hospitalization Data and Rates

- Unless otherwise specified, 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). Hospitalizations occurring in the U.S. or abroad are not included.

- 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.

- Standardized rates are adjusted by age (collapsed to 5-year groupings) using a direct method of standardization based on the July 1, 1991, Canadian population as follows:

Age (in Years)	Standard Population, Canada, July 1, 1991	Age (in Years)	Standard Population, Canada, July 1, 1991
<1	403,061	45–49	1,674,153
1–4	1,550,285	50–54	1,339,902
5–9	1,953,045	55–59	1,238,441
10–14	1,913,115	60–64	1,190,217
15–19	1,926,090	65–69	1,084,588
20–24	2,109,452	70–74	834,024
25–29	2,529,239	75–79	622,221
30–34	2,598,289	80–84	382,303
35–39	2,344,872	85–89	192,410
40–44	2,138,891	90+	95,467

Source
Statistics Canada, *Causes of Death 1997, Appendix 3,* catalogue no. 82-221-x.

- 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 MED-ÉCHO 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.

7 Identifying Acute Care and Day Procedure Data

The following approach is used to identify qualifying acute care and day procedure cases.

Step 1: Select potential acute care and day procedure records

Table 1A: Potential Acute Care and Day Procedure Records—DAD Data		
	Criteria	**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	**Codes**
Include	Ontario day surgery functional centres	See Table 1D: Day Surgery MIS Functional Centre Codes below
	Ontario and Alberta cardiac catheterization labs	Ambulatory Care Group Code = CL and Ambulatory Type Code = 31 (consisting of MIS functional centre 7*3403700 or 7*4155500)
	Nova Scotia day surgery functional centres	See Table 1D: Day Surgery MIS Functional Centre Codes below
	Alberta day surgery functional centres	See Table 1D: Day Surgery MIS Functional Centre Codes below
	Scheduled emergency department (ED) procedures for Ontario, Nova Scotia, British Columbia, Prince Edward Island, Yukon, Manitoba and Alberta	(Ambulatory Care Group Code = ED [consisting of MIS functional centre 7*3100000, 7*3102000, 7*3104000, 7*3106000, 7*3102500 or 7*3107000] **AND** ED_VISIT_INDICATOR = 0)

Table 1B: Potential Day Procedure Records—NACRS Data (cont'd)

	Criteria	Codes
Include	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.^^ or 1.IJ.54.GQ-AZ
		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.56.^^, 5.MD.57.^^, 5.MD.58.^^, 5.MD.59.^^ or 5.MD.60.^^
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	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		
	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
	Ontario, Nova Scotia and Alberta	
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	

8 Grouping Methodologies

When a patient is discharged from a hospital, information relating to his or her care is recorded on an abstract and electronically submitted to CIHI. CIHI then uses some of this information to assign inpatients to a MCC as well as to a specific CMG. CMGs and MCCs are then used to group patients with similar clinical characteristics for analysis.

9 Building Episodes of Care—Linking Cases Across Hospitals

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 within 0 to 6 hours of 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 within 7 to 12 hours of 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).

Record Linkage

All records with valid health card numbers (HCNs), birthdates, 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 encrypted HCN and patient birthdate.

The linkage methodology allows for linkage across Canada, with the exception of Quebec and Manitoba. In these provinces, linkage can be done only within the province due to the submission format of the HCNs.

As we are unable to link patients who are transferred in and out of Quebec and Manitoba, results from hospitals that routinely transfer patients to or from these provinces may be affected. For example, hospitals that routinely transfer patients to Manitoba or Quebec for cardiac procedures may appear to have higher rates for indicators pertaining to acute myocardial infarction. This issue has specifically been identified for Zone 4 in New Brunswick, as patients from this zone are often transferred to Quebec. Please use caution when interpreting these rates.

10 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 2010–2011 to 2012–2013 data, non-teaching hospitals are allocated to the larger, medium or smaller community hospital peer group based on their volumes (using inpatient cases, total weighted cases and inpatient days). Hospitals are categorized as H1 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 or H3 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.

11 Risk Adjustment

When comparing outcomes across hospitals, it is important to account for differences in patient characteristics that may vary among hospitals; without adjustment, data comparisons can be skewed by differences in patient populations. Risk adjustment is a method used to control for patient characteristics that may affect health care outcomes and improves hospital comparability after the pre-existing influence of patient population is removed.

Statistical regression modelling, an indirect method of standardization in risk adjustment, was used to risk-adjust patient characteristics. Risk factors that were controlled for include age, gender 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 AMI, Overall Readmission), diagnoses were flagged as risk factors if they were recorded as pre-admit conditions on any of the records within patients' episodes 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.

The logistic regression model was employed, except for indicators that had low outcome rates (<1%); in these cases, the Poisson regression model was used, as it gives more accurate values for rare-event outcomes. Coefficients derived from the regression models were used to calculate the probability of an outcome for each denominator case; these were then summed for each hospital (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 multiplying by the Canadian average.

The formula is as follows:

Risk-Adjusted Rate = $\dfrac{\text{Observed Cases}}{\text{Expected Cases}} \times$ Canada Average

Where

Observed cases (O) = the number of observed events (or numerator cases, such as actual number of deaths)

Expected cases (E) = the number of expected events, adjusted for the distribution of risk factors in the hospitals (regions, provinces, etc.). Coefficients derived from regression models used data from each fiscal year to obtain the expected number of cases.

Canada average = the standard population rate, or the Canadian average rate for all provinces and territories for each fiscal year (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 multiplied by 1000 if the indicator is expressed as a rate per 1000)

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

Risk-adjusted rates are calculated at the hospital, health administration region and provincial/ territorial levels. Regional and provincial risk-adjusted rates are aggregated hospital-level data.

It is important to note that the expected performance level of an institution in this indirect method of standardization of risk-adjustment is based on how all institutions perform, because the number of expected cases is calculated based on regression models fitted on all cases from all hospitals. Furthermore, risk-adjustment modelling cannot entirely eliminate differences in patient characteristics among hospitals, because not all pre-admission influences 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. Finally, when interpreting risk-adjusted results, it is recommended that the hospital's result be compared with the Canada average.

Information on Canada averages, 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 Resources section in the Indicator Library for more information about diagnoses types that were used to calculate and risk-adjust indicator rates.

12 Defining Neighbourhood Income Quintile

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 dissemination areas, 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 dissemination area (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 PCCF+ (Version 6A),[3] the postal code of the patient's place of residence at the time of hospitalization was mapped to the corresponding 2011 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. To ensure that the same patient with the same postal code was always assigned to the same DA, a unique combination of encrypted health card number, birthdate and postal code was assigned to the same DA.

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.[4] 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 2011 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.[3] 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.

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 2011 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 Major Surgery Patient Group List— CMG+ Codes

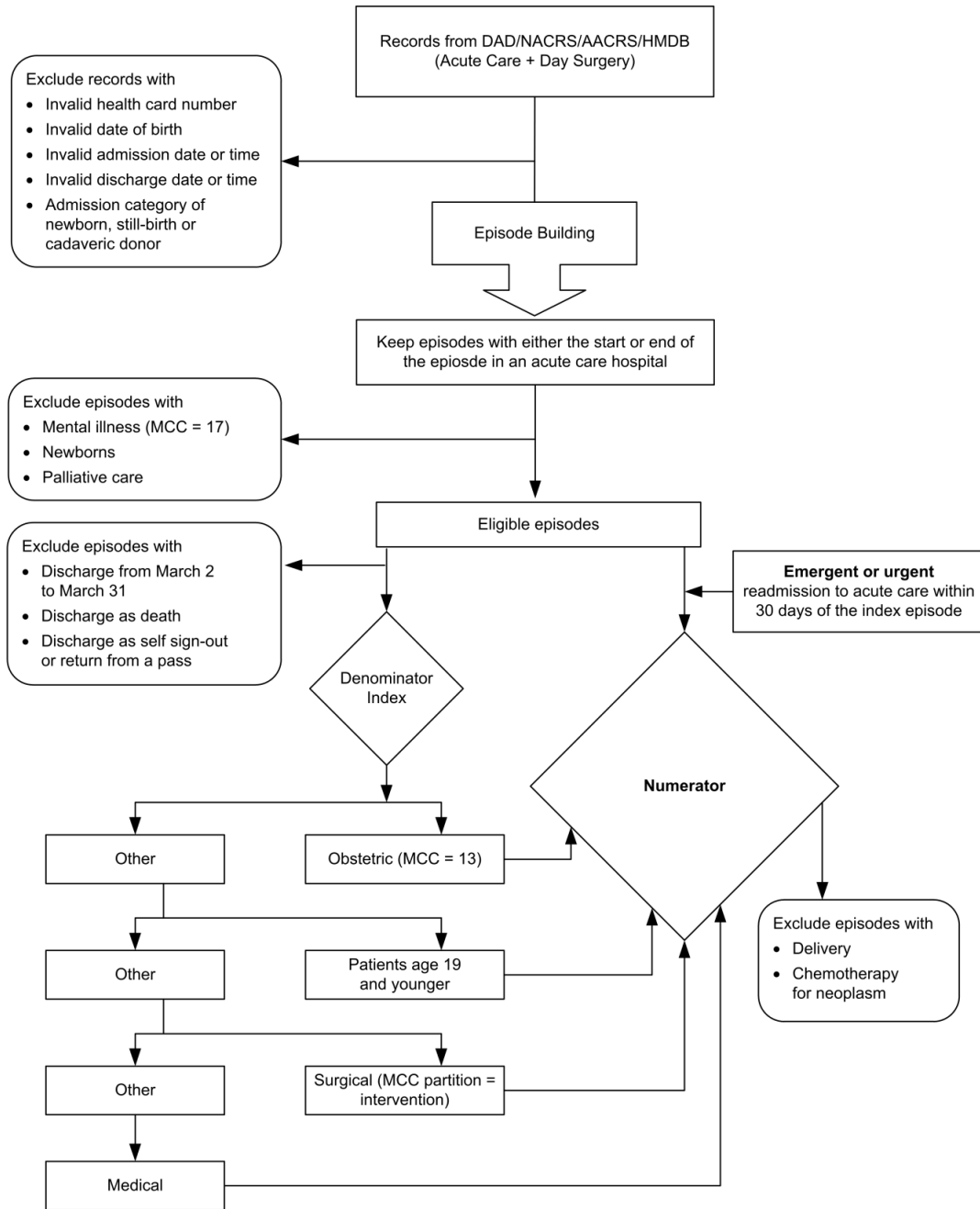The following CMGs include only CMG+ codes linked to major surgical procedures:

CMG+ 2013 (Used for 2010–2011 to 2012–2013):
001, 002, 004, 005, 006, 007, 008, 009, 010, 012, 013, 071, 073, 074, 078, 082, 083, 110, 111, 112, 113, 114, 118, 160, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 180, 181, 182, 220, 221, 222, 223, 224, 225, 227, 233, 270, 271, 272, 273, 274, 276, 277, 300, 301, 302, 303, 304, 305, 306, 307, 308, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 326, 327, 328, 330, 331, 336, 338, 347, 349, 383, 386, 420, 421, 422, 423, 424, 426, 450, 451, 452, 453, 454, 457, 462, 463, 500, 501, 502, 503, 504, 530, 531, 611, 612, 614, 616, 710, 725, 726, 727, 729, 730, 731, 732, 733, 735, 736, 738, 740

CMG+ 2014 (Used for 2013–2014):
001, 002, 004, 005, 006, 007, 008, 009, 010, 012, 013, 071, 073, 074, 078, 082, 083, 110, 113, 114, 121, 160, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 180, 181, 182, 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, 326, 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

14 Flowchart: 30-Day Obstetric/Patients Age 19 and Younger/Surgical/Medical Readmission

Records from DAD/NACRS/AACRS/HMDB
(Acute Care + Day Surgery)

Exclude records with
- Invalid health card number
- Invalid date of birth
- Invalid admission date or time
- Invalid discharge date or time
- Admission category of newborn, still-birth or cadaveric donor

Episode Building

Keep episodes with either the start or end of the epiosde in an acute care hospital

Exclude episodes with
- Mental illness (MCC = 17)
- Newborns
- Palliative care

Eligible episodes

Exclude episodes with
- Discharge from March 2 to March 31
- Discharge as death
- Discharge as self sign-out or return from a pass

Emergent or urgent readmission to acute care within 30 days of the index episode

Denominator Index

Numerator

Other

Obstetric (MCC = 13)

Other

Patients age 19 and younger

Exclude episodes with
- Delivery
- Chemotherapy for neoplasm

Other

Surgical (MCC partition = intervention)

Medical

15 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,[5] the comorbid conditions below are used to calculate the Charlson Index score for each record. Conditions within each group are counted only once (for example, 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 (for example, if I50 and F00 are present on the abstract, the score will be 4).[6]

Description	ICD-10/CCI Codes From Hospital Standardized Mortality Ratio (Original Definitions)	Weight
Congestive Heart Failure	I099, I255, I420, I425, I426, I427, I428, I429, I43*, I50, P290	2
Dementia	F00*, 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
Rheumatological 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, Z944	2
Diabetes With Organ Failure	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, Z940, Z992	1
Moderate or Severe Liver Disease	I850, I859, I864, I982*, K704, K711, K721, K729, K765, K766, K767	4
HIV Infection	B24, O987	4
Primary Cancer	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 Cancer	C77, C78, C79, C80	6

Notes

For provinces other than Quebec, only diagnosis types 1 and (W, X and Y but not 2) 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 asterisk (*) codes.

For Quebec, only diagnosis types 1, C and (W, X and Y but not 2) 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 Charlson Index was calculated for Quebec data for the overall, obstetric, patients age 19 and younger, surgical and medical readmission indicators.

The distribution is as follows:

Charlson Group	Charlson Scores in the Groups, DAD	Charlson Scores in the Groups, HMDB Quebec
0	0	0 and 1
1	1 and 2	2, 3 and 4
2	3+	5+

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