



Patient Cost Estimator

Methodological Notes and Glossary



Canadian Institute
for Health Information

Institut canadien
d'information sur la santé

Production of this document is made possible by financial contributions from Health Canada and provincial and territorial governments. The views expressed herein do not necessarily represent the views of Health Canada or any provincial or territorial government.

Unless otherwise indicated, this product uses data provided by Canada's provinces and territories.

All rights reserved.

The contents of this publication may be reproduced unaltered, in whole or in part and by any means, solely for non-commercial purposes, provided that the Canadian Institute for Health Information is properly and fully acknowledged as the copyright owner. Any reproduction or use of this publication or its contents for any commercial purpose requires the prior written authorization of the Canadian Institute for Health Information. Reproduction or use that suggests endorsement by, or affiliation with, the Canadian Institute for Health Information is prohibited.

For permission or information, please contact CIHI:

Canadian Institute for Health Information

495 Richmond Road, Suite 600

Ottawa, Ontario K2A 4H6

Phone: 613-241-7860

Fax: 613-241-8120

cihi.ca

copyright@cihi.ca

ISBN 978-1-77109-945-5 (PDF)

© 2020 Canadian Institute for Health Information

How to cite this document:

Canadian Institute for Health Information. *Patient Cost Estimator: Methodological Notes and Glossary*. Ottawa, ON: CIHI; 2020.

Cette publication est aussi disponible en français sous le titre *Estimateur des coûts par patient : notes méthodologiques et glossaire*.

ISBN 978-1-77109-946-2 (PDF)

Table of contents

Introduction	4
How does CIHI calculate the estimates?	4
Case Mix Groups	4
Resource Intensity Weight	5
Cost of a Standard Hospital Stay	5
Cost estimates	5
Length of stay averages	6
Estimated average cost limitations	6
Estimated average cost variability	7
July 2020 update	7
Glossary	8
Age group	8
Canadian MIS Database (CMDB)	8
Case	8
Case Mix Group (CMG)	8
Case Mix Group+ grouping methodology (CMG+)	9
Cost of a Standard Hospital Stay (CSHS)	10
Discharge Abstract Database (DAD)	10
Inpatient	10
Length of stay (LOS)	10
MIS Standards	10
Resource Intensity Weight (RIW)	10
Volume	11
For more information	11
Appendix: Historical data and methodology year updates	12

Introduction

The Patient Cost Estimator (PCE) is an interactive tool developed by CIHI to estimate the average cost of various services provided in hospitals. This tool provides information nationally, by jurisdiction and by patient age group. The cost estimates represent the **estimated** average cost of services provided to the average typical inpatient in an acute care facility. They include the costs incurred by the hospital in providing services and exclude physician fees, since physicians are normally paid directly by the jurisdiction and not by the hospital.

Overall, the PCE showcases

- Estimated average costs per Case Mix Group (CMG), by jurisdiction and age group;
- Average length of stay by CMG, by jurisdiction and age group;
- Volumes by CMG, by jurisdiction and age group; and
- Summary reports.

This tool focuses on typical inpatients, representing approximately 83% of all inpatient cases submitted by acute care hospitals to CIHI in 2018–2019. Typical means the hospital patient received a normal and expected course of treatment. Unexpected outcomes, such as deaths, transfers or long stays, are not normally included in the estimated average cost calculations. Please note that some CMGs contain a majority of cases that are not typical (4% of CMGs contained less than 50% typical cases in 2018–2019).

As well, users are cautioned that comparisons of cost estimates or length of stay averages across jurisdictions may not provide comparable results. This is due to differences in care delivery models across the country (e.g., jurisdictions may employ different provider mixes). As well, the financial data provided to CIHI varies across the jurisdictions (e.g., varying wage rates across the country have a significant impact on the cost estimates).

How does CIHI calculate the estimates?

The PCE methodology relies on financial and clinical data provided to CIHI, as well as the CIHI tools discussed below:

Case Mix Groups

Each case submitted to CIHI is assigned a major clinical category (MCC) and CMG based on the nature of the activity and the amount of resources required to provide services within the hospital. Similar activities are grouped together; for example, CMG 110 equals all services provided during an inpatient hospitalization related to a lung transplant. [Read more on the CMG+ methodology.](#)

Resource Intensity Weight

Each inpatient case submitted to CIHI has a Resource Intensity Weight (RIW) assigned to it. This is a value that represents the relative resources used by a patient. Specifically, RIWs are relative values that describe the expected resource consumption of an average patient within a CMG. The RIW can also be adjusted to account for age (e.g., on average, an older patient with more health problems who would tend to consume more resources would have a higher RIW than a younger patient in the same CMG). [Read more on the RIW methodology](#).

Cost of a Standard Hospital Stay

Each jurisdiction has an average cost of a standard hospital stay (CSHS) that was calculated using the total costs provided by the hospitals. The CSHS at the jurisdictional level represents the average cost of 1 patient receiving services in a hospital within that specific jurisdiction. More information on the CSHS methodology and the data used to calculate the CSHS can be found in the In Depth section of the [Your Health System](#) web tool and in the tool's [exported Excel file](#).

Cost estimates

The CSHS for a selected jurisdiction is calculated by taking the financial data held in CIHI's Canadian MIS Database (CMDDB) for 2018–2019 and the weighted cases from the Discharge Abstract Database (DAD) for 2018–2019 grouped using the CMG+ 2019 grouping methodology.

$$\text{CSHS} = \text{total inpatient costs} \div \text{total weighted cases}$$

The cost estimates do not include payments made to physicians or amortization expenses on land, buildings and building service equipment.

The **estimated average cost** for services provided to a typical hospital inpatient is the average generated by multiplying the CSHS for the selected jurisdiction by the average RIW of all typical cases within a specific CMG and age group.

Length of stay averages

There are 3 measures of length of stay (LOS) associated with inpatient stays found in the DAD:

- Total LOS;
- Acute LOS; and
- Alternate level of care (ALC) LOS.

The total LOS represents the patient's days of stay in the facility:

$$\text{Total LOS} = \text{discharge date} - \text{admission date}$$

If the admission date equals the discharge date (the difference is 0), the calculated LOS is 1.

The total LOS is partitioned into 2 components: the acute LOS and ALC LOS.

$$\text{Total LOS} = \text{acute LOS} + \text{ALC LOS}$$

The acute portion of the LOS is related to the number of days the patient spends in hospital receiving acute care. If applicable, an ALC portion may also be provided, representing the number of days spent waiting for placement in alternate care during the patient's hospitalization.

The average LOS for a typical hospital inpatient is the average LOS for all the typical cases within a specific jurisdiction within a specific CMG and age group (in other words, the average of the lengths of stay observed within a defined group of typical patients).

Estimated average cost limitations

The weights used to produce the PCE averages are estimates from the CMG+ methodology and so are based on a system of statistical models. While these produce results that fit most cases reasonably well, there will always be cases that are exceptional. Administrative or clinical issues that are not included in the CMG+ grouping methodology may result in instances where the assigned group or indicators do not appear to fit the data very well. As well, within a CMG, the amount of care required may vary from patient to patient, which means that some cases' actual costs will be below the PCE's estimated average cost and some will be above the estimated average cost.

Estimated average cost variability

The estimated average costs are arrived at through a multi-step process of statistical modelling, adjustment and aggregation. As such, there are multiple sources of variability that affect the final estimate, but not all of these sources may be of interest to a particular user.

The estimate for a particular age group and CMG is the average of the estimated costs of the patients in that group. The variability of these estimates arises through differences in the comorbidities, interventions and other factors of these patients and through the differences in the CSHS of the jurisdictions in which they were treated. When one is not interested in the variability that could be introduced through changes to the mix of comorbidities, factors and jurisdictions, the source that remains is the variability from the statistical modelling and adjustments. Unfortunately we do not currently have a method of estimating this variability.

Without an estimate of the modelling variability, it is not possible to produce a variability estimate for the PCE and, unfortunately, the variability of estimates within a CMG age group is not a good substitute. For example, high variability of these estimated costs may be due to numerous differences in comorbidities and factors, even though the modelling variability might be low. Conversely, if there is little variability of comorbidities, factors and facilities, the observed variability will be low, possibly obscuring a high modelling variability.

July 2020 update

In July 2020, the PCE was updated as follows:ⁱ

1. Grouping methodology year was updated from CMG+ 2018 to CMG+ 2019.
2. Financial estimates were updated from CSHS 2017 to CSHS 2018, using CMDB financial data from 2018–2019.
3. Historical estimates for 2014–2015, 2015–2016, 2016–2017, 2017–2018 and 2018–2019 were added in a downloadable Excel spreadsheet. Please note that historical CSHS values used in previous editions of the PCE are restated for every PCE update. The restated CSHS values may not be identical to the historical values.
4. Cost estimates for Ontario mental health conditions are not representative of Ontario, as cost estimates for CMGs related to mental health conditions for Ontario's inpatient mental health beds were not included in the analysis. A cautionary message in the PCE indicates this.
5. Due to the major restructuring of hospital corporations in Quebec, we have reported only 2015–2016, 2016–2017, 2017–2018 and 2018–2019 CSHS results for comparability. Prior years have not been reported. As a result, we do not have cost estimate values for Quebec for 2014–2015.

i. Please see the appendix for a description of historical updates to the PCE.

Glossary

Age group

Cases are classified into age group categories by the patient's age upon admission.

Neonates:

- A — Newborn
- B — Neonates 0 to 7 days
- C — Neonates 8 to 28 days

Pediatric:

- F — 29 to 364 days
- G — 1 to 7 years
- H — 8 to 17 years

Adult:

- R — 18 to 59 years
- S — 60 to 79 years
- T — 80+ years

Canadian MIS Database (CMDB)

CIHI database housing financial and statistical data from submitting health care organizations across Canada, excluding Nunavut. A standardized accounting framework (the MIS Standards) is used to report and collect revenues and expenses. In general, expenses related to administrative and support services, ambulatory care services, community and social services, diagnostic and therapeutic services, education, nursing inpatient and resident services, and research are submitted.

Case

All the activities related to 1 inpatient during 1 inpatient stay.

Case Mix Group (CMG)

Distinct patient groupings that are clinically similar and/or homogenous with respect to hospital resources used created by using the CMG+ grouping methodology and identified by the CMG code and description.

Case Mix Group+ grouping methodology (CMG+)

Assigns patient records to MCCs and CMGs. Both MCCs and CMGs are based on either a diagnosis or condition described as being most responsible for the patient's stay in hospital, or they are based on an intervention that significantly affects the pattern of care and the resources consumed by a patient.

The MCCs are defined as follows:

- 1 Diseases and Disorders of the Nervous System
- 2 Diseases and Disorders of the Eye
- 3 Diseases and Disorders of Ear, Nose, Mouth and Throat
- 4 Diseases and Disorders of the Respiratory System
- 5 Diseases and Disorders of the Circulatory System
- 6 Diseases and Disorders of the Digestive System
- 7 Diseases and Disorders of the Hepatobiliary System and Pancreas
- 8 Diseases and Disorders of the Musculoskeletal System and Connective Tissue
- 9 Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast
- 10 Diseases and Disorders of the Endocrine System, Nutrition and Metabolism
- 11 Diseases and Disorders of the Kidney, Urinary Tract and Male Reproductive System
- 12 Diseases and Disorders of the Female Reproductive System
- 13 Pregnancy and Childbirth
- 14 Newborns and Neonates With Conditions Originating in the Perinatal Period
- 15 Diseases and Disorders of the Blood and Lymphatic System
- 16 Multisystemic or Unspecified Site Infections
- 17 Mental Diseases and Disorders
- 18 Burns
- 19 Significant Trauma, Injury, Poisoning and Toxic Effects of Drugs
- 20 Other Reasons for Hospitalization
- 99 Miscellaneous CMG and Ungroupable Data

Cost of a Standard Hospital Stay (CSHS)

An indicator that measures the ratio of a hospital's total acute inpatient care expenses to the number of acute inpatient weighted cases related to the inpatients for which the hospital provided care. This indicator can be calculated at the organizational, provincial and national levels. For the purpose of this analysis, the CSHS values at the provincial, territorial and national levels are used.

Discharge Abstract Database (DAD)

CIHI database containing demographic, administrative and clinical data on hospital discharges. CIHI receives DAD data directly from participating hospitals.

Inpatient

An individual

- Who has been officially accepted by a hospital for the purpose of receiving 1 or more health services;
- Who has been assigned a bed, bassinet or incubator; and
- Whose person-identifiable data is recorded in the registration or information system of the organization and to whom a unique identifier is assigned to record and track services.

Length of stay (LOS)

For inpatient abstracts, the calculated difference, in days, between the admission date and the discharge date. If the admission date equals the discharge date (the difference is 0), then the calculated LOS is 1.

MIS Standards

Standards for Management Information Systems in Canadian Health Service Organizations is the standardized accounting framework used to report and collect financial data, such as revenues and expenses, as well as administrative statistical data, such as earned hours.

Resource Intensity Weight (RIW)

A relative cost weight value assigned to each patient care episode in the DAD. It reflects the resource intensity of each patient care episode and is adjusted for a number of factors (including age, comorbidity level and selected interventions).

An RIW is not a dollar value; it represents the relative resources (total hospital service cost including fixed and variable components), intensity (the amount of service utilized) and weight of each inpatient case compared with the typical average case, which has a value of 1.0000.

Volume

The number of typical inpatient cases from acute care facilities. For the purpose of this analysis, the volume does not normally represent all cases, as atypical cases such as deaths, transfers in or out and long stays are excluded. In addition, cases with data quality issues have been removed. Note that cost estimates based on small volumes (less than 30) could be highly variable; please interpret with caution.

For more information

For information on hospital performance indicators, including the CSHS, please visit the In Depth section of the [Your Health System](#) web tool.

[DAD data quality documentation](#)

[*The Cost of Hospital Stays: Why Costs Vary*](#)

This report demonstrates how a case mix methodology (CMG+) can be used to determine relative costs in acute care inpatient hospitals for typical patients. An appendix of average costs associated with all CMGs by MCC is provided.

[*DAD Resource Intensity Weights and Expected Length of Stay \(ELOS\) for CMG+ 2019*](#)
(available at no cost to Core Plan subscribers)

This report explains the expected length of stay (ELOS) calculation and the RIW calculation for typical and atypical acute care inpatient cases. Includes tables containing the base ELOS, trim point and RIW value for each CMG and age group combination, along with a discussion of the activity and cost data sources used for the production of the ELOS and RIW.

[*CMG+ Directory 2019*](#) (available at no cost to Core Plan subscribers)

This product provides more detailed information on MCCs and CMGs. Consult this document to see how the interventions and major diagnoses are classified.

[*Decision-Support Guide: CMG+*](#) (available at no cost to Core Plan subscribers)

This product was developed to increase clients' ability to understand and use CMG+ grouping information and to address increasing demands for case mix understanding and direction on how to use case mix measures and products to inform decision support.

[*Standards for Management Information Systems in Canadian Health Service Organizations*](#)
(MIS Standards) 2019

This product provides the framework for Canadian health care facilities to collect and submit financial and statistical data.

Appendix: Historical data and methodology year updates

July 2019 update

In July 2019, the PCE was updated as follows:

1. Grouping methodology year was updated from CMG+ 2017 to CMG+ 2018.
2. Financial estimates were updated from CSHS 2016 to CSHS 2017, using CMDB financial data from 2017–2018.
3. Historical estimates for 2013–2014, 2014–2015, 2015–2016, 2016–2017 and 2017–2018 were added in a downloadable Excel spreadsheet. Please note that historical CSHS values used in previous editions of the PCE are restated for every PCE update. The restated CSHS values may not be identical to the historical values.
4. Cost estimates for Ontario mental health conditions are not representative of Ontario, as cost estimates for CMGs related to mental health conditions for Ontario's inpatient mental health beds were not included in the analysis. A cautionary message in the PCE indicates this.
5. Due to the major restructuring of hospital corporations in Quebec, we have reported only 2015–2016, 2016–2017 and 2017–2018 CSHS results for comparability. Prior years have not been reported. As a result, we do not have cost estimate values for Quebec for 2013–2014 and 2014–2015.

June 2018 update

In June 2018, the PCE was updated as follows:

1. Grouping methodology year was updated from CMG+ 2015 to CMG+ 2017.
2. Financial estimates were updated from CSHS 2014 to CSHS 2016, using CMDB financial data from 2016–2017.
3. Historical estimates for 2012–2013, 2013–2014, 2014–2015, 2015–2016 and 2016–2017 were added in a downloadable Excel spreadsheet. Please note that historical CSHS values used in previous editions of the PCE are restated for every PCE update. The restated CSHS values may not be identical to the historical values.
4. Cost estimates for Ontario mental health conditions are not representative of Ontario, as cost estimates for CMGs related to mental health conditions for Ontario's inpatient mental health beds were not included in the analysis. A cautionary message in the PCE indicates this.
5. Due to the major restructuring of hospital corporations in Quebec, we have reported only 2015–2016 and 2016–2017 CSHS results for comparability. Prior years have not been reported. As a result, we do not have cost estimate values for Quebec for 2012–2013 to 2014–2015.

May 2016 update

In May 2016, the PCE was updated as follows:

1. Grouping methodology year was updated from CMG+ 2014 to CMG+ 2015.
2. CMGs 546 to 555 were included.
3. Financial estimates were updated from CSHS 2012 to CSHS 2014, using CMDB financial data from 2014–2015.
4. Historical estimates for 2010–2011, 2011–2012, 2012–2013, 2013–2014 and 2014–2015 were added in a downloadable Excel spreadsheet. Please note that historical CSHS values used in previous editions of the PCE are restated for every PCE update. The restated CSHS values may not be identical to the historical values.
5. Key terms were added to the CMG common language search engine.
6. Cost estimates for Ontario mental health conditions are not representative of Ontario, as cost estimates for CMGs related to mental health conditions for Ontario's inpatient mental health beds were not included in the analysis. A cautionary message in the PCE indicates this.

March 2015 update

In March 2015, the PCE was updated as follows:

1. Grouping methodology year was updated from CMG+ 2012 to CMG+ 2014.
2. Financial estimates were updated from CSHS 2010 to CSHS 2012, using CMDB financial data from 2012–2013.
3. Some enhancements were implemented to improve the usability of the PCE.
4. Historical estimates for 2009–2010, 2010–2011, 2011–2012 and 2012–2013 were added in a downloadable Excel spreadsheet. Please note that historical CSHS values used in previous editions of the PCE are restated for every PCE update. The restated CSHS values may not be identical to the historical values.

January 2013 update

In January 2013, the PCE was updated as follows:

1. Grouping methodology year was updated from CMG+ 2010 to CMG+ 2012.
2. Financial estimates were updated from CSHS 2009 to CSHS 2010, using CMDB financial data from 2010–2011.
3. Key terms were added to the CMG search engine.
4. Some enhancements were implemented to improve the usability of the PCE.
5. Historical estimates for 2009–2010 were added in a downloadable format. Please note that 2009–2010 results were calculated using the new CSHS methodology and are not comparable with previous results.

December 2010 update

In December 2010, the PCE was updated as follows:

1. Grouping methodology year was updated from CMG+ 2009 to CMG+ 2010.
2. Financial estimates were updated from CSHS 2008 to CSHS 2009, using CMDB financial data from 2008–2009.
3. Length of stay averages were added and were calculated using the 2008–2009 DAD.

June 2010 update

In June 2010, the PCE estimated average costs were updated as follows:

1. Grouping methodology year was updated from CMG+ 2008 to CMG+ 2009.
2. Clinical data year was updated from DAD 2007–2008 to DAD 2008–2009.
3. Financial estimates were updated from CSHS 2008 to CSHS 2009, using CMDB financial data from 2008–2009.

As data sources and methodologies change, the estimates produced may vary dramatically from those of the preceding year. In particular, numerous changes were made to the CMG+ grouping methodology in 2009 to better reflect the coding of patient abstracts submitted to the DAD. Changes in grouping methodology and fluctuation in CMDB and DAD data often result in large variation (both increases and decreases) in the average estimated costs provided by the PCE. These changes are not unexpected, in particular among low-volume CMGs.

November 2009 (initial release)

In November 2009, CIHI released the PCE, and the estimated average costs were generated as follows:

1. Grouping methodology year was CMG+ 2008.
2. Clinical data year was DAD 2007–2008.
3. Financial estimates were from CSHS 2008 held in CIHI's CMDB for 2007–2008.



help@cihi.ca

CIHI Ottawa

495 Richmond Road
Suite 600
Ottawa, Ont.
K2A 4H6
613-241-7860

CIHI Toronto

4110 Yonge Street
Suite 300
Toronto, Ont.
M2P 2B7
416-481-2002

CIHI Victoria

880 Douglas Street
Suite 600
Victoria, B.C.
V8W 2B7
250-220-4100

CIHI Montréal

1010 Sherbrooke Street West
Suite 602
Montréal, Que.
H3A 2R7
514-842-2226

cihi.ca

22488-0620

