Bulletin

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Functional Area Resource Intensity Weight Proportions

Technical Notes and Glossary

Introduction

This document provides an overview of the methodology used by the Canadian Institute for Health Information (CIHI) to produce national resource estimates (proportions) for functional areas by Case Mix Group (CMG). These proportions may be used in combination with the Resource Intensity Weights (RIWs) to estimate resource use per functional area for each CMG.

The estimated proportions and corresponding variation measures are presented by functional area and by CMG in the electronic client tables on the Case Mix web page of CIHI's website. Please see the appendix for a description of the functional areas.

Please consult the document *DAD Resource Intensity Weights and Expected Length of Stay for CMG+ 2012* for specific information related to the RIW methodology.

How to Use the Functional Area RIW Proportions to Estimate Resource Use

Say you are the clinical manager of an obstetrics unit. You want to better understand the costs incurred in your inpatient nursing unit. Most of your patients are grouped into the following two CMGs:

559—Primary Caesarean Section
RIW: 0.79

563—Vaginal Delivery
RIW: 0.42

Using the client table, you will see that for the CMGs you are interested in, the functional area proportions are as follows:

CMG	Inp Nursing Services	Outp Nursing Services	Operating & Recovery Room Nursing Services	Totl Nurs	Clinical Lab	Medical Imaging	Other Professional Services	Indirect Costs	Grand Totl
559-Primary Caesarean Section	59%	0%	9%	68%	4%	0%	1%	27%	100%
563-Vaginal Delivery	68%	0%	0%	69%	3%	0%	1%	27%	100%

You can see that the proportion of total nursing costs is very similar for the two patient groups—68% and 69%. Patients grouped to CMG 563 incurred all of their nursing costs within the inpatient nursing services functional area, while patients in CMG 559 also incurred costs in the operating and recovery room nursing functional area.

For a patient in CMG 559, the relative cost weight representing the resources expended on nursing services is calculated as follows:

- 0.68 x 0.79 = 0.54.

The relative resource weight spent on operating and recovery room nursing services is 9%, or 0.09 x 0.79 = 0.07.

You also know that the cost per weighted case (CPWC) for your hospital is $5,300. Therefore, the estimated average cost for a patient grouped to CMG 559 is calculated as follows:

- 0.79 x $5,300 = $4,187.

The total nursing services cost is estimated as follows:

- 0.68 x $4,187 = $2,847

Of this, $2,470 is for inpatient nursing services and $377 is for operating and recovery room nursing services.

The total estimated average cost for a patient in CMG 563 is calculated as follows:

- 0.42 x $5,300 = $2,226.

Furthermore, for a patient in CMG 563, total nursing services accounted for 69% of the total estimated average cost, with a relative cost weight of 0.29, or $1,537.[1]

Please consult the document *Canadian MIS Database—Hospital Financial Performance Indicators, 1999–2000 to 2009–2010* for specific information related to the CPWC methodology.

[1]. Data in the example is for illustration purposes only and does not reflect actual or RIW values.

The Data

To complete the calculations, CIHI used clinical data from the Discharge Abstract Database (DAD[2]), which was grouped using the CMG+ 2012 grouping methodology, and the patient cost data from the Canadian Patient Cost Database (CPCD[3]) from Alberta, British Columbia and Ontario from 2007–2008 and 2008–2009. The patient cost data was collected in accordance with the *Standards for Management Information Systems in Canadian Health Service Organizations* (MIS Standards) 2006.[4]

Two years of data were used to include sufficient volumes to provide stable estimates. The same cost data was used to develop the RIW and expected length of stay (ELOS) products for CMG+ 2012; however, for the purposes of this product, only typical cases were included. Typical means the hospital inpatient had a normal and expected course of treatment. Unexpected outcomes, such as deaths, transfers or long stays, were excluded.

Table 1 below provides a summary of the volume of typical acute inpatient cases used in the calculations, by province and fiscal year.

Table 1: Acute Typical Inpatient Case Volumes Used for Functional Area RIW Proportions Calculation

Fiscal Year	Province	Volume of Cases
2007	Ontario	176,922
2007	Alberta	182,032
2007	British Columbia	40,780
2008	Ontario	228,979
2008	Alberta	183,744
2008	British Columbia	30,820

Source
Canadian Patient Cost Database, Canadian Institute for Health Information.

Please note that CMGs containing diagnoses and/or procedures related to termination of pregnancy (CMG 546 to 555) are suppressed in the client tables.

Methodology

CIHI underwent a consultation process with CPCD data providers to define the functional areas and develop methodologies to address specific data quality challenges, such as the lack of comparability in the case of pharmacy costs.

[2]. The DAD contains data on hospital discharges across Canada.
[3]. The CPCD contains patient-level cost data on discharges from three provinces.
[4]. The MIS Standards are the accounting standard for Canadian health service organizations.

Functional Areas

Using the functional centres from the MIS Standards 2006 in the cost data, CIHI was able to define seven functional areas:[5]

- Inpatient nursing services (N)
- Outpatient nursing services (A)
- Operating and recovery room nursing services (O)
- Clinical laboratory (L)
- Medical imaging (G)
- Other professional services (P)
- Indirect costs (I)

According to the MIS Standards, the simultaneous equation allocation method is used to allocate costs in administrative functional centres to the patient care functional centres. In patient costing, these costs are further allocated to the patient, resulting in patient cost records that contain both direct and indirect costs within the patient care functional centres.

It is important to note that the indirect costs functional area includes all costs reported on the patient cost record in the administrative and support services functional centres (71 1 ** **), as well as any indirect costs that were allocated to the patient care functional centres. Thus all costs reported within each of the other functional areas are direct costs.

Please see the appendix for functional area definitions.

Allocation of Pharmacy and Drug Costs to Nursing Functional Areas

At the patient cost record level, pharmacy and drug costs are allocated to the relevant nursing functional centres to maximize comparability. Specifically, costs captured under the pharmacy functional centres (71 4 40 **) are allocated to the inpatient nursing services, outpatient nursing services, and operating and recovery room nursing services functional areas based on the distribution of the direct costs of each functional area (N, A and O) as a proportion of total nursing functional areas.

Calculating the Proportions

The resource estimates by functional area and CMG are generated by aggregating patient costs for each functional area by CMG. The proportions of cost for each functional area in each CMG, describing the distribution of costs within each CMG, are calculated by dividing each functional area's total dollar cost by the total dollar cost for the CMG.

Finally, each estimated proportion is accompanied by a variance measure to provide additional information to the user.

Data Limitations

1. Low volume: Generally speaking, as resource intensity level (RIL)[6] changes, the proportions of resources consumed within each functional area vary. It would be ideal to produce functional

[5]. See the appendix for detailed functional area definitions (by MIS functional centre).

area estimates at the RIL. However, more than half of the CMG/RIL combinations with RIL >3 have fewer than 30 observations, creating unstable estimates at that level of specificity. Thus, due to low volumes, it was not feasible to calculate more than one series of proportions per CMG. Fortunately, the majority of patients have RIL = 1 (low complexity). As volumes increase, CIHI may be able to provide a more specific RIL proportional estimate.

2. Lack of comparability: There is some inconsistency in the patient costing methodology employed at the facility and jurisdictional levels in capturing drug-related and pharmacy costs. It was decided that costs within the 71 4 40 ** functional centres (pharmacy, prescription and wardstock drug costs) would be included with the nursing functional areas, since this is a reporting requirement of the MIS Standards. Improved reporting over the next two years is expected to address this issue and allow for the future creation of a drugs functional area.

Assessment of Variance in Estimates

For the user to assess the precision of the proportions, confidence intervals are provided.

Variability can be looked at in two ways: relative and absolute. The confidence interval provides a relative measure. The importance of each way of looking at variability depends on the situation and how the proportions are used.

Calculating Variation Measures

In order to calculate variance, patient-level cost data (by functional area for each CMG) was used to estimate the confidence intervals of the average cost per patient for the functional area of each CMG. The average cost calculations need to include both zeros and non-zeros, so patient cost records remained in the calculations even when they reported no cost in a functional area.

The estimated proportional resource consumption of a functional area is calculated by dividing the average cost per patient for the functional area by the total average cost per patient. For the reported variability measures, the calculations are initially done on the dollar scale; the dollar scale values for the measure are then re-scaled to be the percentage (relative to total scale for the CMG). In the interactive table provided, the user can enter the facility level CPWC to see the confidence intervals estimated at the facility level, based on facility costs and on the national average typical RIW.[7] Users may also enter facility specific RIWs to further refine the estimates.

Please note that the estimates for certain CMGs are very variable, so the confidence interval may include negative values. For this analysis, a negative confidence interval limit was converted to 0. Similarly, confidence interval limits higher than 100% were set at 100%.

[6] RIL summarizes the overall factor effects by CMG and age; for example, a higher RIL represents resources utilized to provide care to a more complex patient.

[7] National average RIW was calculated using the RIW values from all patient abstracts submitted to the DAD in 2010-2011 representing typical acute care inpatient stays.

Assumption

This conversion of the variability measures from the dollar scale to the proportion scale (percentage) treats the average total cost within each CMG as a constant when, in fact, it is an estimate and subject to variation. This means that both the numerators and denominators of the proportions have some variability. This analysis focuses on the variability of the numerators when calculating the estimates in percentage. Thus the random effect on the denominator is taken out by treating the total costs in each CMG as constant. In this case, the numerator and denominator can be expected to be positively correlated, which makes these confidence intervals somewhat conservative.

For More Information

For more information, please refer to the following documents:

Patient Cost Estimator—Methodological Notes and Glossary (available at no cost)
www.cihi.ca/CIHI-ext-portal/internet/EN/ApplicationIndex/applicationindex/applications_index_main

DAD Resource Intensity Weights and Expected Length of Stay, 2011 (available at no cost to Core Plan subscribers)
www.cihi.ca/CIHI-ext-portal/internet/en/tabbedcontent/standards+and+data+submission/standards/case+mix/cihi010690

Canadian MIS Database—Hospital Financial Performance Indicators, 1999–2000 to 2009–2010 (available at no cost)
https://secure.cihi.ca/estore/productSeries.htm?locale=en&pc=PCC137

MIS Standards—Patient Costing Methodology (available at no cost)
www.cihi.ca/cihi-ext-portal/internet/en/tabbedcontent/standards+and+data+submission/standards/mis+standards/cihi010691

Appendix: Functional Area Definitions (Based on MIS Standards 2009)

Functional Area	Functional Centre Numbers Included
Inpatient Nursing Services (excludes operating and recovery room): **N**	**Direct Costs in Functional Centres** • 71 2 ** ** ** Nursing Inpatient Units **And** Estimated inpatient portion of 71 4 40 **Except** • 71 2 60 Operating Room • 71 2 62 Combined Operating Room and Recovery Room • 71 2 65 Post-Anesthetic Recovery Room
Outpatient Nursing Services (excludes operating and recovery room; includes community services): **A**	**Direct Costs in Functional Centres** • 71 3 ** ** ** Ambulatory Care Services • 71 5 ** ** ** Community Services **And** Estimated outpatient portion of 71 4 40 **Except** • 71 3 60 Day Surgery Operating Room • 71 3 62 Day Surgery Combined Operating and Post-Anesthetic Recovery Room • 71 3 65 Day Surgery Post-Anesthetic Recovery Room
Operating and Recovery Room Nursing Services: O	**Direct Costs in Functional Centres** • 71 2 60 Operating Room • 71 2 62 Combined Operating Room and Recovery Room • 71 2 65 Post-Anesthetic Recovery Room • 71 3 60 Day Surgery Operating Room • 71 3 62 Day Surgery Combined Operating and Post-Anesthetic Recovery Room • 71 3 65 Day Surgery Post-Anesthetic Recovery Room **And** Estimated operating and recovery room portion of 71 4 40
Clinical Laboratory: L	**Direct Costs in Functional Centres** • 71 4 10 ** ** Clinical Laboratory
Medical Imaging: G	**Direct Costs in Functional Centres** • 71 4 05 Diagnostic and Therapeutic Services Nursing • 71 4 15 ** ** Diagnostic Imaging
Other Professional Services: P	**Direct Costs in Functional Centres** • 71 4 20 Radiation Oncology • 71 4 25 Electrodiagnostic Laboratories • 71 4 30 Non-Invasive Cardiology and Vascular Laboratories • 71 4 35 Respiratory Therapy • 71 4 45 Clinical Nutrition • 71 4 50 Physiotherapy • 71 4 55 Occupational Therapy • 71 4 60 Audiology/Speech–Language Pathology • 71 4 65 Rehabilitation Engineering • 71 4 70 Social Work • 71 4 75 Psychology • 71 4 76 Genetic Counselling • 71 4 80 Pastoral Care • 71 4 85 Recreation • 71 4 90 Child Life

Indirect Costs: I	**Direct and Indirect Costs in Functional Centre** 7 1 1 Administration: 71 1 10 Administration 71 1 15 Finance 71 1 20 Human Resources 71 1 30 Communications 71 1 25 Systems Support 71 1 34 Emergency Preparedness 71 1 35 Materiel Management 71 1 40 Volunteer Services 71 1 53 Plant Administration 71 1 55 Plant Operation 71 1 60 Plant Security 71 1 65 Plant Maintenance 71 1 70 Staff Transport 71 1 45 Housekeeping 71 1 50 Laundry and Linen 71 1 75 Bio-Medical Engineering/Medical Physics 71 1 79 Interpretation and/or Translation Services 71 1 80 Registration 71 1 82 Admission/Discharge Coordination 71 1 85 Service Recipient Transport 71 1 90 Health Records 71 1 95 Service Recipient Food Services **And** all indirect costs allocated to patient care functional centres reported on the patient cost record in the CPCD