

Guidelines on Person-Level Costing Using Administrative Databases in Ontario

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The authors declare that they have no competing interests.

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Purpose of the report

Accurate person-level costing data has wide application in research and is often used to estimate cost-of-illness, cost effectiveness studies and for efficiency analysis. The primary objective of this report is to introduce a costing methodology that can be used to derive person-level costs in a variety of healthcare settings, including inpatient acute care, ambulatory emergency department and same day surgery, inpatient rehabilitation, inpatient mental health, complex continuing care, long-term care, home care and physician services. The costing approach presented here relies on data that is routinely available in Ontario, Canada. It is expected that with some adaptation, the approach could be used in other jurisdictions.

This report specifies how person-level costs can be derived by linking utilization data from administrative healthcare databases and both individual provider and corporate cost information collected by the MOHLTC. Person-level costing data can be aggregated to estimate the direct cost of publicly-paid healthcare services for any population or sector of interest (e.g. diabetics in primary care or cancer survivors across the entire healthcare system) and over any time period for which cost and utilization data are available.

Acronyms and Abbreviations

ACG	Ambulatory Care Groups
ADP	Assistive Devices Program
CACS	Comprehensive Ambulatory Care Classification System
CADTH	Canadian Agency for Drugs and Technologies in Health
CCAC	Community Care Access Centers
CCC	Complex Continuing Care
CCI	Canadian Classification of Health Interventions
CCM	Comprehensive Care Model
CCRS	Continuing Care Reporting System
CIHI	Canadian Institute of Health Information
CMG	Case Mix Group
CMI	Case Mix Index
COI	Cost of Illness
CPI	Consumer Price Index
CPRWPD	Cost per Rug-Weighted Patient Day
CPWC	Cost per Weighted Case
DAD	Discharge Abstract Database
ED	Emergency Department
FFS	Fee-For-Service
FHG	Family Health Group
FHN	Family Health Network
FHO	Family Health Organization
GAPP	General Alternative Payment Program
HCD	Home Care Database
ICD-10-CA	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada – Canadian Modification
ICD-9-CA	International Statistical Classification of Diseases, Injuries, and Causes of Death, 9th Revision, Canada – Canadian Modification
ICES	Institute for Clinical Evaluative Sciences
IR	Inpatient Rehabilitation
LHIN	Local Health Integration Network
LOS	Length of Stay
LTC	Long Term Care
MCC	Major Clinical Categories
MDS	Minimum Data Set Resident Assessment Instrument
MH	(Inpatient) Mental Health
MIS	Management Information Systems
MOHLTC	Ontario Ministry of Health and Long Term Care
NACRS	National Ambulatory Care Reporting System
NDFP	New Drug Funding Program
NPC	Nursing and Personal Care
NRS	National Rehabilitation Reporting System
OA	Other Accommodation
OCCI	Ontario Case Costing Initiative
ODB	Ontario Drug Benefit database
OECD	Organisation for Economic Co-operation and Development

OHCAS	Ontario Home Care Administrative System
OHIP	Ontario Health Insurance Plan
OMHRS	Ontario Mental Health Reporting System
PAC-10	Prospective Complexity Adjustment Weighting System
PSS	Program and Support Services
RAI-MDS	Resident Assessment Instrument – Minimum Data Set
RBC	Resident Basic Co-Payment
RCW	Rehabilitation Cost Weight
RF	Raw Food
RIO	Rurality Index for Ontario
RIW	Resource Intensity Weight
RPDB	Ontario Registered Persons Database
RPG	Rehabilitation Patient Group
RUG	Resource Utilization Groups
RWPD	RUG-Weighted Patient Day
SDS	Same Day Surgery
SHA	System of Health Accounts (Developed by the OECD)

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1 Introduction

Understanding how healthcare dollars are spent and attributing healthcare spending to individuals is an important activity for accountability and comparative performance monitoring and evaluation. For this purpose, healthcare payers have developed comprehensive healthcare cost accounting systems. Internationally, efforts have been made to ensure macro or nation-level comparability through the development and implementation of the Organisation for Economic Co-operation and Development (OECD) System of Health Accounts (SHA).[1]). Macro-level cost information can offer insights into how much spending is directed toward broad categories of health services, such as hospital-based acute care, or physician reimbursement. Depending on the detail available in the underlying data, it is also common to attribute costs and understand spending for particular disease groups such as cardio-vascular conditions or dementia. This is often accomplished by calculating spending in various healthcare settings according to the diagnoses of interest (e.g. acute hospitalizations with a primary cardiovascular diagnosis).

Neither approach provides insight into costs at the individual or person-level over time. There are considerable advantages to having a person-level costing system including the ability to accumulate costs over an extended episode of care and the ability to identify persons whose cost profile may be affecting the average cost of providing care across individual providers, networks, or regions.

This document provides guidance on how to identify appropriate unit costs associated with individual healthcare utilization and how to combine these costs with utilization data from administrative databases. These can be used to measure the formal component of direct healthcare costs, i.e. costs incurred by the payer. These costs can be aggregated and compared across various dimensions. In Ontario, Local Health Integration Networks (LHINs) receive block grants from the Ministry of Health and Long Term Care (MOHLTC) and are now the payers for institutional and home and community care services. The MOHLTC directly reimburses physicians and pharmacies for services and medications. The LHIN regional payers and other provincial payers are the primary audience to use the methods in this report to better understand costs and to benchmark and set cost targets within their jurisdictions.

Although many audiences may find this report valuable, the target audiences for this report are researchers and decision-makers intending to use cost data for purposes such as cost-of-illness calculations, cost-effectiveness studies, and provider efficiency analysis studies. In **cost-of-illness studies**, the burden of illness is typically estimated as the excess costs, both direct and indirect, that were generated by all persons in the population who have a specific health condition relative to a comparable population without the specific health condition. These can be used as baseline healthcare costs for comparative analyses and may be helpful to rank and prioritize among conditions based on the health system cost burden. **Cost-effectiveness studies** compare two or more alternative interventions or technologies in terms of additional gain in clinical outcome relative to the additional cost of a new treatment. Cost-effectiveness studies in Ontario can benefit from using unit costs described in this report to calculate costs associated with healthcare use based on administrative data (potentially linked to prospectively collected data). **Efficiency studies** can also be conducted to measure and compare cost performance of providers or networks of providers using provider-specific unit costs.

This report provides two valuable contributions to the practice of costing using administrative data in Ontario that are also generally applicable in other jurisdictions where similar data are available. The first contribution is the method of allocating health system costs to the person-level in all sectors of the health system. The second is the use of micro- or person-level utilization in combination with encounter-specific costs to estimate full health system costs for any individual in the population.

1.1 Costing Perspective

Economic evaluation involves decision-making along several dimensions. An analysis of costs can be conducted from different perspectives, such as societal, public healthcare payer, or individual. The perspective chosen will dictate which costs will be included. For example, the societal perspective implies that all direct and indirect costs, whether incurred by government, individuals or employers, need to be taken into account. This would include items such direct medical and non-medical costs, opportunity costs such as income forgone as a result of impairment, disability or illness, and non-pecuniary costs, such as loss of independence, pain and change in quality of life of a person and/or their informal

caregiver. If the study takes a perspective of the payer, then it may be appropriate to only account for direct medical costs, since these are the costs that are often the most relevant to the policy planners and decision-makers. In this report we outline a methodology for calculating direct medical costs incurred by the MOHLTC thus taking the perspective of the Ontario public healthcare payer. Costs incurred by individuals (e.g. copayment for medications and accommodation, canes/walkers, transportation) or private insurers are generally not addressed by this report.

1.2 Approaches to healthcare cost allocation (top-down and bottom-up)

The allocation of total healthcare spending to individuals can be developed using two different approaches. Top-down approaches aim to disaggregate total healthcare spending from the total health budget to sectors (through systems such as the OECD SHA) and then to providers. Top-down approaches have the advantage that they are usually comprehensive and ensure that all healthcare spending is allocated and accounted for. These approaches are best suited to fairly macro-level analyses and at best meso-level analyses at the provider level or for populations of interest.

Bottom-up or micro-level costing approaches start with individual encounters or utilization in the health system and attaches prices (or costs or amounts paid) to each encounter. In the context of Ontario's public medical insurance system, prices are rarely set by providers in a private marketplace. Therefore costs or amounts paid by the MOHLTC are used in this report. Costs per encounter or episode may be derived from billing data or calculated based on attributable cost information developed through top-down approaches. The advantage of person or micro-level costing data is that any individual's healthcare costs can be measured and aggregated to any higher level of analysis as appropriate (e.g. by geography, clinical condition, age or sex grouping). If individual utilization can be linked across sectors then a comprehensive assessment of person-centered healthcare spending can be developed. Such costs are particularly useful for a wide range of purposes including estimating burden or cost-of-illness and for cost-effectiveness studies. Micro or person-level costing generally suffers from the limitation of not being able to account for all healthcare costs, leaving out for example public health, community health clinics, some capital costs and other types of costs that are either public goods or otherwise difficult to

associate with an identifiable individual's use of such resources. This report uses a bottom-up approach to costing services at the individual level over time. Where individual unit costs are not available (e.g. for institutional care settings), the methods outline a top-down approach that allocates corporate aggregate (i.e. institutional) costs to individual visits or cases/episodes of care.

1.3 Person-level costing: units of utilization and unit costs

This report describes the methods used to implement a person-level or micro-level costing approach using administrative databases in Ontario. Measuring person-level healthcare expenditures requires two primary components: *utilization data*, (e.g. length of stay and intensity of resource usage), and *cost information* (e.g. cost per stay or per day). On the utilization side, currently detailed person-level data for a wide variety of healthcare settings are collected and stored in administrative databases by the Canadian Institute for Health Information (CIHI) and the MOHLTC. CIHI and the MOHLTC have implemented comprehensive data collection across the entire spectrum of healthcare services in order to improve system accountability and planning, and to monitor efficiency in the healthcare system. In addition, in order to better manage and finance provision of healthcare, the MOHLTC and CIHI have implemented various case-mix systems of patient classification in most health settings. Case-mix systems categorize individuals into clinically and statistically homogenous groups based on clinical administrative data.

Costing information for specific utilization in sectors that are funded using global budgets or related aggregate institutional or organizational payments are derived in this report using top-down allocation methods based on the amounts paid by the MOHLTC to providers for the relevant care sectors, primarily hospitals. In the top-down method, hospital costs are first attributed to each major health service sector (examples are acute, rehabilitation, complex continuing care, same day surgery and other ambulatory care) based on the Ontario Cost Distribution Methodology (OCDM). The OCDM was developed and is maintained by the Health Data Branch of the MOHLTC. Service sector costs are then attributed to individual units of utilization recorded in the associated utilization database (e.g. Discharge Abstract Database for acute inpatient care). In the top-down method, home care costs are accounted for in specific service accounts (e.g. nursing, homemaking)

according to Management Information System (MIS) standards set by the Canadian Institute for Health Information (CIHI) and reported in the Community Care Access Centre (CCAC) year end comparative reports. Details are provided in the methodology presented in Section 4.

In other care sectors including pharmacy and physician payments, it is common to find fees associated with each unit of health care. These generally represent the fee paid by the payer (MOHLTC or LHIN) for a particular product or service. In such cases the unit costs are directly obtained as the fee paid for the service or product.

Once costs for specific utilization are established, the costing methods applied here use a bottom-up approach to costing services at the person-level by combining appropriate unit costs with person-level utilization data. The resulting person-level cost estimates can be used to measure MOHLTC healthcare costs in all or certain populations, and is a valuable tool for conducting health economics research.

2 Healthcare Utilization: Units of Measurement

2.1 Service Utilization

Reliable person-level utilization data in terms of used resources or services is invaluable in case-cost estimation. In Canada, national and provincial healthcare administrative databases provide detailed data regarding service utilization by individuals. The type of information typically found in administrative databases includes personal identifiers, demographic and clinical data, and, most importantly, person-level information on the type and intensity of resources consumed. These data are maintained by the MOHLTC and may be made available within the limits of privacy regulations to prescribed entities or other individuals or groups. A comprehensive collection of administrative claims and billing data is housed at the Institute for Clinical Evaluative Sciences (ICES) and can be used to identify and determine person-level healthcare utilization. The data housed at ICES includes:

- Ontario Registered Persons Database (**RPDB**): *demographic information, date of death for the entire population with valid health card numbers*
- Discharge Abstract Database (**DAD**): *acute inpatient hospitalization*
- Ontario Mental Health Reporting System (**OMHRS**): *mental health*
- Continuing Care Reporting System (**CCRS**): *complex continuing care*
- National Rehabilitation System (**NRS**): *inpatient rehabilitation*
- National Ambulatory Care Reporting System (**NACRS**): *same day surgeries and emergency department, outpatient oncology and dialysis treatments*
- Ontario Health Insurance Plan (**OHIP**): *physician services*
- Ontario Drug Benefit (**ODB**) and New Drug Funding Program (**NDFP**): *prescription drugs*
- Ontario Home Care Administrative System (**OHCAS**) and Home Care Database (**HCD**): *home care*
- Assistive Devices Program (**ADP**) database

Many of these databases have been validated and described in the literature (**Appendix Table 1**), and used as a source of data for costing analyses in Ontario [2-4].

2.2 Utilization Intensity and Case-Mix Adjustment

Even among persons with the same diagnosis, there is variability in disease severity. Hence, persons with the same clinical diagnosis can have very different resource utilization profiles, and as a result have very different cost profiles. A range of factors such as age, sex, co-morbid conditions, physical and cognitive functioning and past medical history can explain some of these differences. Therefore, when trying to estimate a case-cost, it is important to know not only the type of services that a person used but also the usage intensity.

In Canadian acute hospitals, the measure of resource utilization intensity is known as Resource Intensity Weights (RIWs). An RIW value is assigned to each hospital inpatient and represents the average amount of hospital resources (including administration, staff, supplies, technology and equipment) used by individuals with a particular condition relative to the average resources consumed by other persons (A person with an RIW of 2.0 used twice as many resources as a person with an RIW of 1.0). These weights were developed by CIHI and are part of *Case Mix methodology* for acute care. CIHI's RIW methodology classifies persons with similar resource use patterns into statistically and clinically homogeneous groups based on their clinical and administrative data profile.[5] Similar case mix classification methods have been developed for other healthcare settings. Ontario has adopted case mix methodologies for acute care, emergency (ED) and day surgery (SDS), inpatient rehabilitation (IR), complex continuing care (CCC), long-term care (LTC) and mental health (MH). In these settings all unit costs will be referred to as *weighted* unit cost, where the word *weighted* indicates that the cost was adjusted to reflect intensity of resource utilization or case-mix of persons in a given care settings.

2.3 Data Linkage

One of the most useful features of healthcare administrative databases lies in the possibility to link person-level records across different healthcare sectors, thus obtaining complete utilization information on all services used by an individual. Each Ontario resident is assigned a unique health card number that can be encrypted and allow linkage of utilization from different care providers over time at the person-level under stringent privacy

protocols. The sensitive nature of these data means that they are afforded special protections under Ontario law. Only Prescribed Entities (a defined term under the provincial Personal Health Information and Protection of Privacy Act) are able to work with these data, and even then special conditions must be met with respect to the care and control of the data. ICES is one such entity where individual data can be linked across databases using an encrypted unique personal identifier, known as the ICES Key Number (IKN). Once the data have been linked, the relevant variables for the estimation of healthcare utilization are the person's length of stay and the weight assigned to him/her during the treatment period. In some settings, such as CCC and MH, persons can be assessed multiple times during their stay generating multiple utilization records within the same episode across which resource intensity weights may change. In these settings it is important to keep track of such changes, and properly reflect them in the cost calculation.

3 Healthcare Costs: Developing Unit Costs

3.1 Costing Data Sources

This report provides a costing methodology for distinct healthcare service categories based on the healthcare utilization data and methods suggested by Canadian Agency for Drugs and Technologies in Health (CADTH).[6, 7] The service categories are:

- acute inpatient hospitalizations,
- emergency visits (ED),
- same day surgeries (SDS) and other ambulatory treatments (e.g. dialysis, oncology)
- inpatient rehabilitation (IR),
- complex continuing care (CCC),
- long-term care (LTC),
- inpatient mental health (MH),
- physician services,
- home care,
- prescription drugs,
- equipment (devices).

This section presents a high-level overview of the derivation of unit costs with additional technical details described within each sector in Section 4 of this report.

3.2 Unit Costs: Hospital-Specific vs. Provincial-Average

In order to determine person-level case costs we first need to calculate unit costs. The approaches for each sector in the healthcare system are summarized in **Exhibit 1** below. For services with relatively short episodes of care (**Exhibit 1**, Group 1), such as acute or inpatient rehabilitation hospital care or same day surgery the unit cost is a cost per weighted case (CPWC). For services with longer episodes of care (**Exhibit 1**, Group 2), such as CCC, MH and LTC, the basic costing unit is cost per weighted day. Unit costs for services such as physician visits and home care depend on the nature of the visit and type of provider and are measured as a cost per visit or per hour (**Exhibit 1**, Group 3).

Exhibit 1. Summary of services types, weights and unit cost title

Type of Service	Utilization Database	Utilization Unit	Weight Name	Unit Cost
Group 1: Short Episodes (mean<60 days)				
Acute Hospitalization	DAD	Weighted Case	RIW	CPWC
Same Day Surgery & Outpatient	NACRS	Weighted Case	RIW	CPWC
Emergency Department	NACRS	Weighted Case	RIW	CPWC
Inpatient Rehabilitation	NRS	Weighted Case	Rehabilitation Cost Weight (RCW)	CPWC
Group 2: Longer Term Episodes				
Complex Continuing Care	CCRS	Weighted day	CMI	CPRWPD
Long Term Care Home	CCRS	Weighted day	CMI	CPRWPD
Inpatient Mental Health	OMHRS	Weighted day	SCIPP CMI	CPMHWD
Group 3: Visits/Claims				
Primary and Specialist Physician	OHIP	Visit	n/a	Fee Paid
Home Care	OHCAS, HCD	Visit	n/a	Cost/visit
Pharmaceuticals	ODB	Prescription	n/a	Amount Paid
Equipment	ADP	Device	n/a	Amount Paid

Unit costs can be either calculated as the *provincial-average* or *provider-specific*. Average costs can vary across providers (e.g. hospitals), not only due to differences in efficiency but also because of fixed costs associated with different activities (e.g. teaching) or with geographic location (e.g. small rural hospitals). Whether provider-specific or provincial-average unit costs are most appropriate depends on the research objectives of the study. Provincial average costs are appropriate for an economic analysis of a hypothetical individual, where one does not know where in the province the individual might be treated. In contrast, for analyses of healthcare provider efficiency, or to determine actual costs incurred for a narrowly defined sub-population in a particular geography, provider-specific costs will be the most useful. Once cost per unit is determined, the analyst can derive case cost for all individuals in the cohort of interest, by multiplying the unit cost by the weight corresponding to the person's stay and/or the number of units of service (days, hours, number of visits) used.

3.3 Deriving Unit Costs

Micro-level cost data are available for visit and claim-based payments. Eligible payments associated with physician visits are available directly from OHIP Schedule of Claims and Benefits while fees paid to physicians are tracked in the OHIP physician billing database. Prescription drug payments paid to pharmacies for dispensed medications for Ontario residents over 65 years and for those receiving funding through provincial disability programs are recorded in the ODB. Amounts reimbursed to claimants for equipment are recorded in the ADP database. Micro-level cost data are not available for institutional care settings. Total costs (direct and indirect/overhead costs) for acute care, SDS, ED, MH and CCC are available for each hospital from the MOHLTC Health Data Branch. Similarly average unit costs for home care are derived from annual financial reports submitted by CCACs in accordance with Ontario Healthcare Reporting Standards/Management Information Systems (MIS). LTC per diem costs are published each year and historical data are maintained by the MOHLTC.

Unit costs that are to be combined with utilization claims must be based on a comparable scale. Where financial databases include only total provider costs, unit costs must be calculated. This is true in Ontario for hospital services, for CCAC services and for some physician costs. It is also necessary to ensure that the cost per weighted case is measured with the same weighting system that will be applied to specific case weights. There are multiple possible weighting approaches available. The two dominant approaches in Ontario are the CIHI RIW system and the MOHLTC Prospective Complexity Adjustment (PAC-10) weighting system. The MOHLTC monitors and allocated efficiency performance payments based on cost per weighted case assessed using on the PAC-10. This was implemented to counteract up-coding on the part of hospitals including identifying diagnoses related to RIW complexity weights. In this report we adopt the CIHI RIW system because it is more generally representative, it applies to other jurisdictions and it includes complexity weights associated with additional comorbidities that are not included in the PAC-10 system.

To derive unit costs for **hospital** settings the costing data must match the utilization data. The OCDM allocates hospital costs reported in the MIS database to inpatient acute care

(associated with utilization included in the CIHI DAD), inpatient rehabilitation (associated with the NRS), complex continuing care (associated with the CCRS), same day surgery (associated with NACRS SDS), emergency departments (associated with NACRS ED), dialysis and oncology treatment (associated with NACRS dialysis and oncology ambulatory care). While the OCDM also provides an allocation for ambulatory clinic visits in hospitals, there is no person-level database that is associated with these visits and ambulatory clinic visits in acute care cannot be attributed to individuals at this point in time.

Hospital-specific costs per weighted case can be derived by dividing the total hospital costs for each cost centre (e.g. inpatient acute, rehabilitation etc) by the total case-weight (e.g. total RIW, Total RCW, etc) for each cost centre where the former are obtained from the OCDM and the latter from the respective utilization databases for the appropriate reporting period (fiscal year). Provincial average costs per weighted case are obtained by first summing up each hospital's total costs for the applicable cost centre to the provincial total and dividing by the total provincial case-weights from the respective utilization database. For example, the total cost per weighted case for **acute care activities** at a hospital can be found by summing the total net direct and indirect costs for acute and newborn care obtained from the OCDM data set and dividing by the total RIW in the DAD. The same approach is followed for **ambulatory care** (ED, SDS, dialysis, oncology) in each case dividing hospital-reported costs in each cost center by the total hospital weighted case volumes associated with each specific cost center. MIS provides cost-centre reporting fully aligned with inpatient databases. CPWC for **inpatient rehabilitation** are available from two sources: values for 2004/05 were reported in an Ontario Joint Policy and Planning Committee (JPPC) 2006 Technical Report [8] and the 2009/10 update [9]. CPWC for inpatient rehabilitation is not provided on an annual basis, therefore extrapolating between years 2004/05 and 2009/10 is necessary. Values for earlier years can be derived assuming the same growth rate in CPWC as for acute hospitals. Similarly the total Cost per RUG Weighted Patient Day (CPRWPD) for complex continuing care can be calculated by summing the total net direct and indirect costs for **complex continuing care** (also obtained from the OCDM data set) and dividing by the total CMI-weighted days from the CCRS.

Home care costs by service types are available from CCAC year-end comparative reports including both CCAC-specific costs and provincial average costs. CCAC case-management (a direct service cost) and CCAC costs for administration and case-management can be allocated to each individual served by dividing the respective total spending for these two categories for the province and/or each CCAC by the number of individuals served. Each individual with a HCD record will then be assigned a fixed annual cost associated with administration and case-management services provided by the CCAC. It would be difficult but possible to distribute costs based on a variable cost driver such as the intensity of services provided. While case-management is unlikely equal for all clients, a substantial amount of these costs are incurred on admission for assessment and determining service eligibility and a care plan. These costs are expected to constitute the majority of case-management activity and these are relatively fixed for all clients. Therefore the average approach to allocating these costs is appropriate. Further work is required to better understand case-management costs in the home care sector.

In settings where fee-for-service (FFS) billing is used for **physician services**, a direct link can be made between an individual person and physician service billings for that person. Determining the costs of physician services can be more problematic in settings where simple fee-for service billing is not used. In settings where physicians are compensated using capitation models, salary, or alternative payment plans, an alternate approach to estimating physician costs for an individual is needed. The funding formula can be used for primary care capitation payments and is described in the methodology for physician payment in Section 4. Shadow billing costs are then added based on the visit and fee-paid. This approach most closely captures costs incurred by persons but is not necessarily a reflection of the health system resources consumed by these individuals if one considers that total FFS payments may be larger for individuals with fewer physician visits compared to shadow-billing payments for individuals with relatively more physician visits. Relative resource consumption in primary care can be estimated by using the physician fee schedule of payments in place of the fee paid for each visit or alternatively by the median fee paid for that particular visit type. The latter approaches do not however represent actual payments to physicians or the costs incurred by the persons and distort differences in costs

across different physician compensation models. The recommended approach here best captures the costs attributable to each person.

When alternative payment models are used (such as for emergency department or oncology), it is suggested that the cost associated with a visit by individuals to any one of the physicians in an alternative payment plan be estimated as being equal to the total monthly stipend for the physician divided by the total number of applicable visits by each individual to these physicians in the month prior to the payment. Lacking measurement of differential effort and resource intensity for these visits, the costs for each visit are allocated on an equal basis. This is largely in keeping with the distribution of these payments to individual physicians. To the extent that physicians bill in a relatively timely manner and relatively uniformly throughout the year, this approximation will be a feasible and an accurate estimate. Non-uniform billing and practice patterns can lead to mis-estimation of the appropriate costs using this approach.

The next section describes how unit costs and utilization should be combined to develop estimates of person-level health costs by healthcare sector. Combining these costs across health sectors using a common and unique person identifier enables person-level health system costs to be estimated.

4 Cost Estimation Methodology

Once the two primary costing components, namely utilization and unit costs, are known, estimation of individual case-costs becomes relatively straightforward. For services that implement case-mix methodology and where the unit cost is per *weighted case* (acute hospitals, SDS, ED, IR) a case-cost would be a product of the resource weight for the specific episode (which reflects intensity of service utilization and acuity of a particular person) and the appropriate unit costs (**Appendix – Table 2**). For case-mix services where unit cost are measured on a *per diem* basis (CCC, MH and LTC), case-cost can be found as a product of three components: utilization intensity weight, length of stay, and per diem cost. For services with a service-specific cost, such as home care, physician services, prescription drugs, tests and diagnostic procedures, a case-cost is trivially a unit cost (cost per visit, per hour, per service, per prescription). As with most rules, there are occasionally some exceptions, for example long- and short-stay outliers in IR or persons enrolled in capitation-based programs (family health organization (FHO), family health network (FHN)) do not conform to the general rules. However, such exceptions are few and approaches are described in this Section.

In order to make this report accessible and comprehensive, the notation is kept consistent throughout, where subscript i indicates an individual person, superscript j denotes a provider, and index y implies that quantity is year-specific.

4.1 Inpatient Hospitalizations

Inpatient Acute Utilization

The number and type of hospitalizations can be determined from the DAD and hospitalization costs estimated using the Resource Intensity Weight (RIW) method [10-13]. CIHI classifies all acute discharges recorded in the DAD by a Case Mix Group (CMG), which was developed to categorize groups of persons with similar clinical and resource utilization patterns. Within each CMG, cases are further stratified into distinct age categories (**Appendix – Table 3**). In 2007 CIHI introduced new acute care inpatient grouping methodology known as CMG+. The main objective of this project was the redevelopment of

CIHIs existing acute care inpatient grouping methodology and RIWs using the World Health Organization's International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada (ICD-10-CA) and the Canadian Classification of Health Interventions (CCI) activity and cost data. Costing data for calculation of RIWs are calculated using data from a limited set of participating Case Costing hospitals in Ontario and Alberta [14]. CMGs are developed based on a person's major diagnosis as well as procedures or interventions received. The base RIW is calculated by CIHI for each CMG + age group (**Appendix – Figure 1**), and then the base weight is adjusted on a case-by-case basis for length of stay, comorbidity level and interventions received. In particular, CMG+ makes use of 9 age groups, 16 flagged intervention groups, and five comorbidity levels (**Appendix, Table 3**). As a result, an RIW is assigned to each inpatient case representing the level of resources used relative to a reference inpatient case [11]. RIWs of typical cases are calculated per case using the methodology outlined above. For atypical cases, such as long-stay outliers, transfers, sign-outs or deaths, RIW has a per diem component. (In this way costs for Alternate Level of Care (ALC) days are included in the RIW calculation.) Overall, the higher a person's RIW the more hospital resources he/she had consumed during the stay. RIWs are standard and linear in nature. A person with an RIW of 2.0 will have consumed twice the resources as a person with an RIW of 1.0. This property affords the RIW useful arithmetic properties, including the ability to sum and apportion the RIWs. The standardization of RIWs across hospital inpatient and outpatient care is a further advantage of this approach.

Inpatient Acute Costs

In order to estimate the specific case cost of person *i* admitted to hospital *j* in a given year *y*, the hospital-specific cost per weighted case (CPWC) for Ontario is multiplied by a person's RIW for a given hospitalization (**Equation 1.1**). As discussed in section 3.2, depending on the research objectives, CPWC can be calculated at the hospital (**Equation 1.2**), regional, or provincial level. Although hospital-specific costs are more accurate, the use of provincial costs better reflects the average costs in the province and ensures case cost estimates only reflect service utilization and representative costs at the provincial level, not location-specific variation in costs. The nature of the study being undertaken

should be used to decide whether local (hospital-specific) cost estimates or provincial averages are more appropriate to use in the analysis.

$$\text{Case Cost}^j_i(y) = RIW_i(y) * CPWC^j(y) \quad (1.1)$$

$$CPWC^j(y) = \text{Total Acute Care Costs}^j(y) / \text{Total Weighted Cases}^j(y), \quad (1.2)$$

where Total Weighted Cases for all persons $i=1...N$ at hospital j are given by $\sum_{i=1}^N RIW_i$

Year-specific costs per weighted case can be calculated by dividing the hospital-specific costs reported in the OCDM database by the total inpatient activity in each specific cost center (e.g. sum of DAD RIW for acute inpatient, sum of NACRS ED RIW, etc). These data are available from the MOHLTC Health Data Branch.[16] Regional or provincial average costs can be calculated using the same approach but including the total of all regional or provincial hospitals in the total cost calculation (numerator) and in the total weighted inpatient activity (denominator). By calculating the unit costs based on allocating OCDM total costs to available utilization records we can ensure that the sum total of utilization will equal the provincial spending. Current provincial-average costs per weighted activity calculated using ICES databases are presented in **Appendix – Table 2**. Costs related to physician services provided in hospital are not included as part of the cost per weighted case, as these are paid directly to physicians through OHIP. Alternatively average costs can be obtained from the Canadian Hospital Financial Performance Indicators report.[15] The latter source calculates the average cost as the sum of all provincial inpatient costs divided by the sum of all provincial weighted cases, excluding outliers.

4.2 Emergency Room, Same Day Surgery and High-Cost Ambulatory Care Services

Ambulatory Care Utilization

The NACRS dataset contains all data describing visits to the emergency room and day procedures in Ontario since 2002-2003. Beginning in 2006 utilization has been tracked for high cost ambulatory clinics, namely dialysis and oncology (separate accounting was also incorporated in the OCDM). Prior to 2006 the latter utilization was not tracked and costs were included alongside general outpatient clinic cost centres. Since costs may vary

across the different cost centers that are included in the NACRS database and since costs are allocated separately in the OCDM to emergency room, same-day-surgery, outpatient dialysis and oncology, utilization and weighted costs can be measured separately for each type of ambulatory care. Individuals in NACRS are classified based on the Comprehensive Ambulatory Classification System (CACS) methodology which groups individuals based on their main problem, interventions received, age and gender. This process is somewhat analogous to the CMG+ classification scheme used for inpatient hospitalizations. These CACS groups are then assigned an individual resource intensity weight (CACS RIW) to each case that reflects the average resource utilization for the CACS group relative to the average SDS case. Although the NACRS database was created in 2003, CACS RIWs were first developed in 2006. For studies beginning in 2006 or later, analysts can use year-specific RIWs. The standard CIHI NACRS database for 2003 through 2005 only includes CACS 2008 RIW and therefore the 2008 RIW would be appropriate for studies that include data from years prior to 2006. If a study spans the period prior to and after 2006, the 2008 RIW should be applied from the initial year of study through to 2008 (see comment on year-specific weighting in section 5.2).

Ambulatory Care Costs

Case cost for same day surgery, ED and high-cost (dialysis and oncology) ambulatory clinic is estimated by multiplying year- and visit-specific CACS weight by provincial cost per CACS weighted case (CPCACSC) (**Equations 2.1, 2.2**). Although the CACS RIW is the same for all CACS groups and is equivalent to the inpatient acute CPWC starting in April 2006, the CPCACSC (cost) should be estimated based on the total reported MIS costs and total reported NACRS CACS weights based on the utilization database used for the analysis to ensure that the total cost associated with the utilization database is equal to the total provincial costs for that cost center. Calculation of the cost per weighted case for the CACS (CPCACSC) is equivalent to that of the acute care (**Equation 1.2**).

$$\text{Case Cost}_i^j(y) = \text{CACS RIW}_i(y) * \text{CPCACSC}^j(y) \quad (2.1)$$

$$\text{Visit Cost}_i^j(y) = \text{CACS RIW}_i(y) * \text{CPCACSC}^j(y) \quad (2.2)$$

$$\text{CPCACSC}^j(y) = \text{Total Care Costs}^j(y) / \text{Total Weighted Cases}^j(y), \quad (2.3)$$

where Total Weighted Cases for all persons $i=1...N$ at hospital j are given by $\sum_{i=1}^N RIW_i$ for each cost-center/care type (ED, SDS, oncology, renal).

Ambulatory Care Not Tracked

Costs associated with outpatient clinic visits in hospital settings (e.g. ambulatory orthopedic or ophthalmology clinic visits) are not addressed in the current methodology. Prior to 2006 these also included dialysis and oncology outpatient visits. It is hoped that future algorithms will address this gap as these clinic visits account for an average of about 15-17% of all acute care costs. Unit costs could be derived based on the total costs and total number of related visits to hospitals assuming that all clinic visits consume an approximately equal amount of hospital resources. If individual physician claims for these visits can be linked to the same hospitals and cost centres then this hospital-cost can be included. Fee-for-service physician claims for hospital-based care are included in physician costs as described below (Section 4.8).

4.3 Inpatient Rehabilitation

Inpatient Rehabilitation Utilization

Length of stay (LOS) in inpatient rehabilitation (IR) can be determined from the NRS, which captures submission of data from all Ontario facilities with adult IR beds as mandated by the MOHLTC. Costs of rehabilitation stays are based on the Joint Policy and Planning Committee's (JPPC) Rehabilitation Patient Group (RPG) case mix classification methodology and weighting system, developed to reflect inpatient costs of rehabilitation in Ontario [8, 17]. These methods have previously been used to estimate rehabilitation costs in Ontario [18]. Each IR case is classified into one of 83 RPG based on a person's age, length of stay, and level of disability as measured by the admission Functional Independence Measure (FIM) motor score and admission FIM cognitive score [8]. The FIM motor and cognitive scores are calculated from the national rehabilitation reporting system (NRS) based on a sum of each individual component (ranging from a value of 1 (totally dependent) to 7 (complete independence)) (**Equation 3.1** and **Equation 3.2**), resulting in maximum scores of 84 and 35 respectively.

FIM motor = sum FIM score (eating, grooming, bathing, dressing upper, dressing lower, toileting, bladder management, bowel management, bed/chair/wheelchair transfer, toilet transfer, locomotion walk/wheelchair, locomotion stairs) (3.1)

FIM Cognitive = sum FIM score (comprehension, expression, social interaction, problem solving, memory) (3.2)

Each RPG corresponds to a unique RCW, representing the average resource use for individuals within an RPG. Unlike RIW weights for acute care that are reported in the DAD, RCW are not provided in the NRS and need to be assigned or, in some cases (e.g. long-term outliers), calculated by an analyst. Ontario Joint Policy and Planning Committee's Rehabilitation Technical Working Group developed the cost weights reflective of Ontario IR costs in 2006 with an update in 2010 [8, 9] (**Appendix – Table 4**).

For all short-term outliers, i.e. persons with the length of stay less than 3 days, the RCW is on a per diem basis and is set to 0.016 [9]. For persons with a length of stay greater than the upper RPG-specific trim point (long-term outliers), the RCW is set to the RCW (indexed by RPG) plus the trim (indexed by RPG) subtracted from the rehabilitation length of stay, then multiplied by the Per Diem Rehabilitation Cost Weight (PDW) (**Equation 3.6**).

$$\text{Long-Term RCW} = \text{RCW}_{\text{RPG}} + (\text{LOS} - \text{Trim}_{\text{RPG}}) * \text{PDW}_{\text{RPG}} \quad (3.6)$$

Inpatient Rehabilitation Costs

Rehabilitation case cost for person i in rehabilitation facility j admitted in year y can then be determined as the average cost per weighted case multiplied by the person's RCW (**Equation 3.7**). Provincial average CPWC for IR for years 2002-2009 can be found in **Appendix – Table 2**.

$$\text{Case Cost}_{i,j}(y) = \text{RCW}_i(y) * \text{CPWC}(y) \quad (3.7)$$

4.4 Complex Continuing Care

Complex Continuing Care and Utilization

Hospitalizations in Complex Continuing Care (CCC) are tracked in the CCRS. The CCRS contains assessment information collected using the Resident Assessment Instrument Minimum Data Set (RAI-MDS) for Nursing Homes. Stays in CCC may extend over a wide range of time periods ranging from weeks to years and an episode of care is therefore measured in days. During a stay, the intensity of care (and resources consumed) is usually fairly stable from day to day (or week to week). The weighting system for persons in CCRS is called Resource Utilization Groups (RUG), which are analogous to the CMG groupings for acute hospitalizations. CCC patients are classified into one of 44 distinct RUG groups based on a person's clinical diagnosis, physical and cognitive abilities, as well as services and treatments received that are recorded in the. Each RUG group is associated with a Case Mix Index (CMI) that is a weight approximating the relative daily cost of care for a resident within a given RUG in comparison to the average level of resource use among the CCC population (**Appendix – Table 5**). If a person falls into more than one RUG category they are assigned to the group with the highest CMI.

Persons with extended stay in CCC are assessed every quarter, and following this assessment their CMI can be adjusted either upward or downward. Therefore, resource utilization over time can be represented as a discrete function (**Figure 2**). Multiple CMIs need to be taken into account and properly reflected in cost calculation for persons with long stays. There are two weighting systems used in the CCRS. One for CCC comprises 44 groups associated with the RUG-III classification system and another for residents in LTC Homes that comprises 34 groups associated with the RUG-II classification system. The primary difference between the two classifications is the number of distinct rehabilitation groups (4 in the RUG-II and 14 in the RUG-III system).

Complex Continuing Care Costs

After obtaining the admission, discharge and interim assessment dates and a CMI for each assessment, the cost for each person i treated in a CCC facility j is calculated by multiplying the assessment-specific CMI by the facility-specific cost per RUG Weighted

Patient Day (CRWPD) and the number of days spent in care in every assessment period t (LOS) (**Equation 4.1**) [19].

$$Case\ Cost_i^j = \sum_{t=1}^T CMI_{it} * LOS_{it} * CRWPD^j(y) \quad (4.1)$$

Where LOS_{it} is the time from the most recent assessment (t) to next assessment/discharge ($t+1$); t ranges from 1 (admission assessment) to the last available assessment (T). Note in the first period the LOS will extend from admission (not necessarily the assessment date) to the second assessment date or discharge date. In the final period (T), LOS_{it} will represent the time from the last available assessment until discharge or the end of the study period.

4.5 Long Term Care

Long Term Care Utilization

LTC utilization typically extends over a prolonged and indeterminate period of time and utilization over an episode of care is measured in days. Persons who live in LTC are required to pay a co-payment for accommodations in a LTC facility; however the MOHLTC covers costs of clinical care. Payment for LTC in Ontario is provided to LTC homes within four spending envelopes: nursing and personal care (NPC), program and support services (PSS), raw food (RF), and other accommodation (OA). Fixed level payments are made to homes for PSS and RF envelopes; the OA envelope is set and then adjusted based on residents' ability to pay the resident basic co-payment (RBC). The NPC is adjusted for resident acuity and care needs. Prior to April 2010, Alberta Resident Classification System (ARCS) was used to determine resident acuity in Ontario LTC and the facility's average resident case-mix was used to adjust the level of funding provided to each LTC Home. However, as of April 2010, concomitant with the implementation of RAI-MDS assessments in LTC the Ministry moved to adopt a RAI-MDS based case mix classification system for the purpose of adjusting the base per diem Nursing and Personal Care (NPC) amount. This new system is based on Resource Utilization Groups (RUGs) similar to the ones presently used in CCC. LTC residents are assessed quarterly using RAI-MDS and, following this assessment, are assigned into one of 34 RUG-II groups based on their care

needs, types of treatment received and certain conditions or diagnoses. Each RUG-II group is associated with a CMI that is a weight approximating the relative daily cost of care for a resident within a given RUG in comparison to the average level of resource use among the LTC population (**Appendix – Table 6**). If a person falls into more than one RUG-II category, they are assigned to the group with the highest CMI.

The resident's LOS in the LTC facility can be determined with different options available for different time periods. Prior to 2003 LOS can be estimated by determining admission and discharge from the ODB database using LTC flags for drugs dispensed to persons in LTC and the RPDB. The following methods have been used in earlier research [2]. For the first method, the date of entrance is determined as the first of a minimum of 2 consecutive 'LTC flags', with a date of exit similarly determined as the first of 2 non LTC-flagged drug claims or from a date of death in the RPDB. Another method starting from 2003 and onward is the Client Profile Database (CPRO) which tracks application and admission to LTC can be used to identify the date of admission to LTC (but not discharge which still needs to be determined based on OHIP and ODB claims, or death). As of 2010, the third method uses RAI-MDS which provides a single source for case-mix measurement as well as admission and discharge dates. The MOHLTC provides a bed-hold policy and continues to reimburse LTC homes for resident care while residents are cared for in other institutional settings. The bed-hold policy applies for 21 days for medical (acute care) leave or for 25 days for psychiatric hospital care leave which may be extended by up to 30 additional days. During this period residents are also required to pay the resident copayment levels for the accommodation fees. After the expiry of the bed-hold period, LTC facilities are required to discharge residents. Stays in institutions other than residential LTC lasting more than 51 days should result in an LTC discharge and an end to the LTC episode and associated costs. Future LTC admissions should then be determined as described above.

Long Term Care Costs

Per diem LTC funding directed by the MOHLTC for each bed in year y is calculated according to **Equation 5.1**. This amount is made up of four envelopes: NPC, PSS, RF, and OA less the person's RBC. The envelopes are updated on an annual basis, and NPC per

diem funding component is adjusted to reflect a persons' acuity in a given LTC home [20]. Historical data on per diem LTC funding is shown in **Appendix – Table 2**.

$$MOHLTC \text{ per diem}(y) = NPC_{adj}(y) + PSS(y) + RF(y) + OA(y) - RBC(y) \quad (5.1)$$

Similar to the case cost calculation for persons in CCC, any changes in the CMI of the person in LTC need to be reflected in the cost calculation by appropriately adjusting individual NPC amount.

From the year 2010 and onward LTC case cost can be estimated using **Equation 5.2**.

$$\text{Case Cost}_i = \sum_{t=1}^T \{NPC(y) * CMI_{it} + PSS(y) + RF(y) + OA(y) - RBC(y)\} * LOS_{it} \quad (5.2)$$

where LOS_{it} is the time from last assessment (t) to next assessment/discharge ($t+1$).

Prior to 2010 LTC costs can be estimated using **Equation 5.3**

$$\text{Case Cost}_i = \{NPC(y) + PSS(y) + RF(y) + OA(y) - RBC(y)\} * LOS_i \quad (5.3)$$

4.6 Inpatient Mental Health

Inpatient Mental Health Utilization

Starting October 1, 2005, MOHLTC mandated using the Minimum Data Set for Mental Health (MDS-MH) for collection of clinical and administrative data for inpatient mental health episodes. These data are stored in the Ontario Mental Health Reporting System (OMHRS). Implementation of this mandate allowed introduction of the Case Mix classification methodology that categorizes individuals in MH into statistically and clinically similar groups, known as the System for Classification of In-Patient Psychiatry (SCIPP) [21]. Similar to other sectors, such as acute care, CCC and IR that already implement case mix classification systems, resource utilization by persons in inpatient mental health can now be reflected more accurately. This individual-level utilization data can in turn be used to arrive to the person-level costs of the MH care.

Prior to OMHRS (October 2005), inpatient mental health costs were recorded in the DAD and in inpatient acute care cost accounts in the MIS database.

Based on MDS-MH assessment done at admission, discharge, or every 92 days for persons with longer stays (**Figure 3**), individuals are assigned to one of 49 clinical SCIPP groups. These groups are: Schizophrenia and other psychotic disorders (18 groups), Cognitive disorders (4 groups), Mood disorders (12 groups), Personality disorders (2 groups), Eating disorders (1 group), Substance related disorders (3 groups), Other disorders (7 groups), Ungroupable (1 group) and Not Mental Health (1 group). The assignment to the primary group is based on the diagnosis, while assignment to the secondary group is a function of other clinical variables, such as aggression, depression, suicidality and others, which are collected from the individual and reported in the MDS-MH.

Similar to the CCC and LTC settings, the per diem weights assigned to individuals in MH are known as Case Mix Indexes (CMIs), however there is a distinction in CMI assignment that is specific to the MH. In particular, an important consideration in mental health data is that the first few days of a person's stay are the most resource intensive, and that the average LOS in a psychiatric hospital is extensive. Therefore, in addition to quarterly assessment of a person's health similar to the one used for LTC and CCC, phase-based approach is implemented for weights assignment (**Figure 4**), where the total LOS is split into three distinct phases: admission (day 1-5), acute (day 6 - 730), and long-term (day 731+). Based on each RAI-MH assessment, a person is assigned to one of the 49 clinical SCIPP groups and the applicable SCIPP group values for the applicable days of the stay (SCIPP_1_TO_5, SCIPP_6_TO_730, and SCIPP_731_PLUS) must be used for weighting.

Inpatient Mental Health Costs

The Case Mix Index for persons in mental health (SCIPP CMI) can change following either a scheduled quarterly assessment or because the person had entered a different treatment phase. Thus, for accurate case costing the analyst must keep track of any changes in a person's CMI either following quarterly MDS assessment or due to a change in the phase of stay, and properly reflect that in the case cost calculation (**Equation 6.1**).

$$Case\ Cost_i^j = \sum_{t=1}^T SCIPP_CMI_{it} * LOS_{it} * CSWPD^j(y) \quad (6.1)$$

where the $SCIPP_CMI_{it}$ is specific to each applicable time period (days 1-5, 6-730 or 731+); LOS_{it} is time from last assessment (t) to next assessment ($t+1$), and $CSWPD^j(y)$ denotes year- and facility-specific cost per SCIPP-weighted patient day.

Facility-specific CSWPD can be estimated using **Equation 6.2**:

$$CSWPD^j = Total\ MH\ cost^j / Total\ SCIPP\text{-}weighted\ patient\ days^j\ (SWPD) \quad (6.2)$$

where $SWPD$ for all persons $i=1..N$ at hospital j are given by

$$SWPD^j = \sum_{i=1}^N \sum_{t=1}^T LOS_{it} * CMI_{it}$$

Persons Treated for Mental Health in Acute Hospital Inpatient Beds

Some persons requiring inpatient mental health treatment are treated in acute care hospitals, rather than mental health hospitals. As a result their utilization information is not stored in OMHRS and case-costing methodology described above is not applicable. Studies by CIHI and the MOHLTC have determined that the DAD-based RIW substantially underweights mental health diagnoses leading to distorted accounting for costs for these individuals. Therefore, for persons treated in inpatient mental health beds in acute care facilities and whose utilization is captured in the CIHI DAD and not in OMHRS, Ontario Case-cost estimates provide a more accurate measure of inpatient mental health costs. The unit costs can be found through Ontario Case Costing Initiative (OCCI) using the CMGs that correspond to Major Clinical Category 19 (MCC 19) – Mental Diseases and Disorders (**Appendix – Table 7**). These unit costs are based on costs reported by OCCI-participating hospitals and are CMG-specific but not hospital-specific.

Case-cost estimates for inpatient mental health costs can be estimated using **Equation 6.3**:

$$Case\ Cost_i = RIW_i \times OCCI\ Cost^{CMG}(y) \quad (6.3)$$

Hospital-specific unit costs are limited to OCCI-participating hospitals that have advanced MIS capability and are thus able to assign costs to individual cases directly. In 2010 there were 28 such hospitals, however in earlier years the numbers varied between 8 and 10, representing a relatively small fraction of all Ontario hospitals. Due to the fact that there are relatively few inpatient rehabilitation case-costing hospitals, only provincial average costs reported by the OCCI are recommended for application to mental health inpatient care in acute care beds.

4.7 Home Care

Home Care Utilization

Home care is organized and services are contracted from independent home care service providers by CCACs. In Ontario there were 43 CCACs prior to the creation of the LHINs but CCACs were reduced to 14 and aligned with LHIN service boundaries as of January 1, 2007. Home care includes services such as visiting health professionals (nurses, physiotherapists, occupational therapists, social workers, speech-language pathologists and dietitians), personal care and support, homemaking, and community health services. Client utilization of home care services are captured in the OHCAS up to 2005 and the HCD from 2005 onwards. Each record represents a single visit or service received, except meals on wheels, homemaking, respite and shift nursing, which are recorded as the number of hours of service received.

Home Care Costs

For services that are costed on a per visit basis, the costs of home care is determined by applying provincial-average cost per service provided in a given year y (**Equation 8.1**), which can be obtained from the MOHLTC Health Data Branch [16] (**Appendix – Table 2**). For services that are costed on a per hour basis, cumulative service cost is found by multiplying the cost per hour by the number of hours the service was utilized – namely for shift nursing, homemaking and respite care (**Equation 8.2**).

$$\text{Service Cost} = \text{Cost per Visit } (y) * \text{Number of Visits} \quad (8.1)$$

$$\text{Service Cost} = \text{Cost per Hour } (y) * \sum_{visits} \text{Number of Hours} \quad (8.2)$$

When calculating total case cost for home care services, it is also important to add a case management fee. Case management fee is calculated by evenly allocating total case management cost paid to the CCACs among all home care clients (**Appendix – Table 2**).

4.8 Physician Services

4.8.1 Fee For Service Visits

All physician services including outpatient visits, interpretation of laboratory exams and diagnostic tests, can be identified through the OHIP claims history database based on the OHIP fee paid (**Equation 7.1**). Physicians may be paid for under a number of different arrangements including fully Fee For Service (FFS), fully salary or a number of blended models that include some capitation and some FFS billings (typically at a shadow-billing rate). All service-based payments are recorded in the OHIP database. Person-level case cost can be calculated by aggregating physician costs incurred by the person over a period of time.

$$\text{Visit Cost}_{\text{feecode}} = \text{OHIP Fee Paid} \quad (7.1)$$

4.8.2 Diagnostic Tests and Laboratory Services

The costs of diagnostic tests and laboratory services are comprised of two components: the physician component and lab/clinic component. The physician component includes the time spent by the physician to analyze and interpret the test results and, if needed follow-up with the person. The associated fees for this component are based on the Physician's Schedule of Benefits and Fees [22] and are part of OHIP along with the rest of physician services. Technical components of tests performed at Independent Health Facilities are included in OHIP billing databases, however the costs for minor laboratory work including blood tests etc. are not. Technical components recorded in the OHIP databases for diagnostic procedures (typically identified as 'J' and 'L' codes) with technical fee billing codes (not professional codes) may be separately identified as 'diagnostic costs'. We do not isolate these costs in the methodology described here. Currently there is no reliable way of estimating costs associated with lab tests not included in the OHIP databases since most laboratories and test clinics are privately owned and paid under global budgets; therefore individual utilization records are currently not widely available.

4.8.3 Non-Fee-For-Service Physician Payments

Alternatively payment rates from the Schedule of Benefits and Fees for Physician Services [22] under the Health Insurance Act could be used as the applicable price for each visit. However, the latter approach generalizes that every person's encounter with a physician is reimbursed fully on a Fee-For-Service (FFS) basis. The latter approach may be useful for assessing relative resource intensity (to the extent that payment rates reflect resource intensity) but will not result in total costs equal to the MOHLTC FFS payments because all physicians do not receive the amounts identified in the physician fee schedule. Calculating and using the mean fee paid for each feecode in the OHIP database will generate a total cost equivalent to MOHLTC FFS payments but does not reflect the amounts actually paid to physicians for these services and therefore does not accurately reflect an individuals' actual cost in the healthcare system. Using a median fee paid (calculated as for the mean fee paid) will be more representative of an individual's resource intensity compared to the mean fee paid but will not result in total costs equal to the MOHLTC FFS payments.

Allocating Capitation, Salary and Practice Reimbursements to Individual Persons

The fee paid in the OHIP database will be accurate for all services paid for under FFS. Physicians participating in alternative funding plans, alternative payment plans or other non-FFS arrangements are paid on the basis of capitation payments, stipend payments and/or salaries. Additional service-based shadow-billing amounts are also paid to encourage physicians to continue to file claims to the MOHLTC to account for visit-based activity.

Although the majority of primary care physicians in Ontario have traditionally been paid according to a FFS model, this has started to change with a growing number of physicians opting in for a capitation based compensation model [23, 24]. Currently most primary care physicians in Ontario are compensated according to "blended" models, with approximately 55% being enrolled in a capitation based blended model (FHN and FHO) and 44.4% in a FFS based blended model (Comprehensive Care Model (CCM) and Family Health Group (FHG)) [23]. There are very few primary care physicians who are in a pure FFS payment plan.

4.8.4 Determining Primary Care Model Rosters and Payments

Analogous to utilization records, allocating non-fee-for-service payments in primary care requires determining which payments physicians were receiving for patients on their rosters. This also requires determining what physician patients were rostered to at a given point in time and what payments model their physician belonged to at that point in time. While transitions between physicians and rosters and physician participation in different models may change at any point in time, to ease calculations, the methodology presented here determines physician rosters and models at the end of each month and uses the formulas from payment schedules to calculate expected monthly payments to physicians. The Client Agency Program Enrollment (CAPE) database includes records of patient enrollment and disenrollment from physician models and can be used to assign patients to applicable primary care models at a given point in time. These are calculated at the end of each month for each patient and monthly premiums are allocated to patients based on the primary care model payment formulas outlined here.

Comprehensive Care Capitation payments

All physicians who have enrolled in a compensation model that includes incentives to provide comprehensive care (FHN, FHO, FHG and CCM) receive a Comprehensive Care Capitation payment (referred to as CompCap in equations below) which is calculated as a base rate (**Table 8.1**) multiplied by an age and sex-adjusted multiplier (**Table 8.2**).

Family Health Networks and Family Health Organization Model payments

FHN and FHO models provide capitation payments for physicians for a pre-defined basket of primary care services provided to enrolled persons, and this is adjusted for a person's age and sex. Annual case-cost for persons in a FHN and FHO can be calculated by multiplying capitation base rate (**Table 8.3**) by the appropriate age/sex multiplier (**Table 8.4**). To calculate monthly costs, the annual amounts provided in Table 8.1 need to be divided by 12. An additional senior care premium is added for persons aged 65 and above (**Tables 8.5 and 8.6**). The basic capitation rates differ between models because the basket of services that are covered by these fees differ between models. All of these payments are recorded in monthly architected payments paid to physicians. However, allocating such

payments out to patients in the prior month would be very difficult so instead we recommend using the formulas to calculate the payments as they would be calculated by the MOHLTC, and distributed to physicians. This recommended approach is summarized in **Equations 7.2** and **7.3** below:

The monthly cost for a person under aged 65 in a FHN or FHO

$$Case\ Cost_i = Capitation(t) \times Multiplier_{sex}^{age} + CCC\ Fee(t) \times CCC\ Rate_{sex}^{age} \quad (7.2)$$

For persons over the age of 65 years in a FHN or FHO the

$$Case\ Cost_i = Capitation(t) \times (Multiplier_{sex}^{age} + Old\ Age\ Multiplier_{sex}^{age}) \\ + CompCap\ Fee \times CompCap_{sex}^{age} \quad (7.3)$$

In addition to these capitation payments, primary care physicians are eligible to be paid shadow-billing fees for services included in the ‘basket of capitated services’. The Guide to Physician Compensation [25] identifies specific enhanced fees and shadow billing premiums for core services to enrolled persons. The FHN and FHO models provide a shadow billing premium of 10% for services in each respective basket of capitated services prior to September 1, 2011 and 15% thereafter. These shadow billing premiums are captured in the fee for service fee-paid field [25]. In addition to payments related to capitated services, physicians are compensated at the rate of 100% of the fee amount outlined in the Schedule of Benefits for out of basket services to all individuals and for all services to non-enrolled persons (with a hard cap on total payments for in-basket services to non-enrolled individuals).

Family Health Groups and Comprehensive Care Model

Physicians in the FHG and the CCM are primarily paid from using FFS but there are small monthly payments for rostered patients. As with FHO and FHN models these are adjusted based on age and sex. Family Health Group physicians also receive a comprehensive care FHG premium which is equal to 10% of the fee schedule and is captured in the fee-for service fee-paid field [25]. This recommended approach is summarized in **Equation 7.4** below:

Monthly cost for person under aged 65 in FHG or CCM:

$$\text{Case Cost}_i = \text{CompCap Fee}(t) \times \text{CompCap Rate}_{\text{sex}}^{\text{age}} \quad (7.4)$$

Other Alternative Physician Payments

Other payments to physicians are paid through a number of different programs. Many of these are recorded in the Architected Payments tables that are tracked monthly by the MOHLTC. For primary care physicians, these include bonus payments for achieving targets in 5 preventative services (pap smears, mammograms, flu shots, immunizations, and colorectal screening) – all of which are paid on a monthly basis to physicians through the Architected Payments. These latter payments are not included here. Future work could consider how to allocate such payments to individual patients. The task is non-trivial. Considerations include ascribing marginal versus average revenue when lump sum payments are made based on a threshold of achievement (e.g. 60% of eligible patients receive the service), whether and how to ascribe value to patients who are treated above the maximum payment threshold (at which point marginal payments are zero) and whether and how to ascribe costs among practices that do not achieve the minimum threshold for payment.

Some specialists also receive compensation under alternative payment plans. In particular, emergency physicians, medical and radiation oncologists are largely paid by stipends in the Alternative Payment Program (APP). These payments are recorded in the General APP database (GAPP). Some of these costs have been incorporated into ICES algorithms as described here. Others require future work. Notably the GAPP is not a widely distributed database and these methods may not be easily replicated.

Allocating costs from physicians compensated using the APP to the person level requires using the monthly payments at the provider level and allocating these costs to individual visits recorded in the OHIP database. Medical and Radiation Oncology are two examples where APP payments are proportionately sufficiently large to justify this undertaking. Lacking measurement of differential effort and resource intensity for these visits, the costs are allocated on an equal basis, that is the cost associated with a visit by individuals to one of the relevant physicians is set as the total monthly stipend divided by the total number of

applicable visits by persons to these physicians in the month prior to the payment. These visit costs are then included in the total physician based costs for the individual.

Emergency physicians also receive Alternative Funding Arrangement (ED-AFA) payments that provide differential payments (paid for through GAPP) for services provided during specific time periods. These are distributed to the hospitals and then physicians and are not included in OHIP FFS billing amounts. Associated claims receive a 25% premium if they occur during summer months where the annual ED service volume is less than 20,000 visits and between December 24th and January 1st regardless of service volumes.

4.9 Prescription Drugs

Prescription drug costs are available from the ODB for adults over age 65, based on the total amount paid to the pharmacy from the MOHLTC, including dispensing fees (**Equation 9.1**).

$$\text{Unit Cost} = \text{Fee paid per prescription} \quad (9.1)$$

4.10 Equipment

The ADP provides subsidies to individuals for high-cost equipment such as wheel chairs, walkers, continuous positive airway pressure (CPAP) devices, and insulin pumps. Individuals must apply with the receipt for the purchase of the equipment and the physician's prescription and are then provided with a subsidy according to a predetermined schedule of payments. These payments are recorded in the ADP database and are calculated based on the amount paid (**Equation 10.1**).

$$\text{Unit Cost} = \text{Amount Paid} \quad (10.1)$$

5 Other Considerations

5.1 Inflation

If the study spans for more than one year, all costs need to be expressed in the present value terms by selecting the baseline year and inflating or deflating the costs from other time periods. The recommended approach is to use the healthcare specific Consumer Price Index (CPI) reported by Statistics Canada (**Appendix – Table 9**). This ensures that costs are expressed in constant dollar amounts and are comparable across time. In order to better reflect the real expenses in the year of practice, year-specific unit costs and inflation rates should be used (**Appendix – Tables 2, 9**). Statistics Canada calculates various price indices that capture price changes for different bundles of goods and services, such as the general, healthcare, and personal care CPIs as well as others. Although general CPI, which represents economy-wide price level, is frequently used, our recommendation is to discount costs using a change in the healthcare-specific CPI since it better captures the price changes in a healthcare industry and thus is more relevant for estimating the healthcare costs. Service-specific inflation factors, such as inflation rate for medical and pharmaceutical products, are appropriate for specific objectives such as estimating the cost of pharmaceuticals used by a cohort of individuals. In order to express costs in the constant dollar amount, one needs to choose a baseline/reference year in which all costs will be denominated. Following this all costs from years prior to the baseline year will have to be multiplied by the corresponding inflation rate, and all the costs from years after the reference year - divided. For example, in order to express 2009 healthcare costs in 2010 dollars, one would multiply them by 1.0128. Similarly, to express 2010 costs in terms of 2008 costs, one would divide 2010 costs by 1.031 (equation to get 1.031 would be $CPI_{2010}/CPI_{2008}=118.5/114.9$).

5.2 Year-specific and Constant RIW factors

RIWs are updated in the DAD and NACRS basis, usually annually. These updated weights capture updated changes in the resources and costs associated with care for individuals in the same CMG over time. It is recommended that year-specific RIW factors be used for costs associated with utilization recorded in the DAD and NACRS databases (acute and

ambulatory hospital care) (RIWs are delineated in the DAD and NACRS as RIWyyyy e.g. RIW2006, RIW2008 etc). This contrasts with consistent weights that are applicable to all years of IR, MH, CCC and LTC settings (because the latter weights are not recalibrated on an ongoing basis). It would be possible to use one constant RIW for most years (RIWyyyy are added to historical DAD records in some cases). However, no one year-specific RIW is available for all previous years' of DAD and even if it were there are at least three reasons to use year-specific RIW weights.

First, the CMG grouper and associated RIW for a given year cannot always be calculated for all prior years depending on the required data elements, meaning that different RIWs will often be necessary for multi-year studies. Second, the RIW for a given year was the method used that best represents the actual accounting for costs in the given year. Third, changes in RIW values over years captures changes in internal practices and technology for a particular CMG that are important in terms of resources used. If for example a new bypass procedure requires less equipment and can be completed in less time in the operating room then the new RIW developed after the change in practice captures these decreases in resource intensity but it would not be accurate to apply the new RIW to the care delivered prior to the new procedures.

5.3 Cohort Definition: Prevalent versus Incident Cases

For analytical purposes, the identification of a relevant cohort to which to apply costing methods is a separate consideration from the method of calculating costs but is critical in the application of the methods described here. Cost of illness studies can be performed using either prevalence- or incidence-based methods [26]. Prevalence approaches examine the costs incurred over a given follow-up period taking into account all persons with the given condition, regardless of the date of the onset of disease, thus including all new and old cases. Prevalence studies often focus on a limited time horizon, such as one year. The prevalence-based approach allows an estimate of the total annual burden of the disease, which can then be compared to the total annual cost of other health conditions. Another application of prevalence-based total costs lies in historical comparison. Specifically, costs attributable to a particular health condition can be tracked and compared

over multiple years in order to detect changes, either due to shift in disease prevalence, rate or the treatment costs. Incidence-based approaches examine the costs of disease only among all newly diagnosed cases, are typically future-oriented, and track relevant costs over time until a desired end-point such as a cure or death. If the incidence-based study covers lifetime costs, it can be used to estimate the costs avoided as a result of reducing the number of new cases due to a particular preventive program or intervention.

5.4 Total and Attributable Costs

The methods described in this report identify approaches to measuring total healthcare system costs for individuals. Often these methods will be used to assess costs for individuals with a particular health condition (e.g. diabetics). The methods presented here will provide the total costs for an individual with such conditions but do not represent the attributable or incremental costs associated with that particular condition. In order to measure attributable or incremental costs a comparator needs to be identified and costs need to be compared between people with and without the condition. The best approach to this would include direct matching on measures such as age, sex, geography, primary care model, and other health conditions. A recommended approach is to ‘hard-match’ based on age groups, sex, primary care model and living in community versus Long Term Care (or CCC) and then propensity match individuals based on refined health conditions such as Ambulatory Care Groups (ACGs) and healthcare-related geographical measures such as the Rurality Index for Ontario (RIO). The propensity approach is recommended due to the very large number of ACG and RIO categories.

6 Limitations and Uses

While there are many recommended uses of the methodology reported here, there are also a number of limitations, and the approach is not suitable for all uses.

6.1 Limitations

A significant limitation is that expenditures to operate the healthcare system (such as the cost of the MOHLTC beaurocracy and LHIN staff), as well as **capital costs** for large scale projects (examples would include initiatives to open new long term care beds, or the building of new hospitals) are not reflected in the person level costs derived using the methods outlined in this report. Such costs are not attributable to an individual service or use and are generally attributable to all or large groups of Ontarians regardless of whether they use the service or not. Important health service activities aimed at the community level are not reflected in the person-specific costs calculated using the methodology of this report. This also includes almost all services paid for by the MOHLTC or LHINs where an individual health card number is not tracked at the time of service provision and reported to the payers. Examples include day outreach programs, community services for seniors, supportive housing, public health, and community health clinics. Thus analysts need to consider when generating a person-specific cost whether the absence of these other costs are important to the decision or question they are exploring.

Marginal cost analysis and incremental cost analyses are not facilitated by the broad approach described here. For example, differences in costs associated with different oncology drug regimens within the same hospital for individuals, or differential costs for persons using self-administered pain medication while recovering from surgery, are not measurable with the present approach. In the methods described herein, individuals treated for a particular condition are generally grouped within one CMG or RPG or RUG and individuals within an institution are all allocated the same costs regardless of detailed differences in their person-specific costs.

Costs associated with **specific technologies** performed within acute care hospitals (e.g. Magnetic resonance imaging (MRI), computed tomography (CT) scan etc) are not included

in the methods described here. It is not yet determined how to best calculate valid and representative unit costs in a way that can be attributed back to individual utilization specific to the site at which the technologies were used.

6.2 Uses

Linked data from healthcare administrative databases are a powerful tool for conducting economic analysis since they provide detailed person-level utilization data that spans across almost the entire healthcare system. Utilization of healthcare services combined with the costing data are the primary inputs necessary for cost-of-illness (COI) and efficiency studies, however ability to carry out such studies depends on the availability of accurate person-, hospital- and provincial-level costs. In this guide we have outlined the methodologies to calculate individual costs, as well as provided historical unit costs in Ontario for the majority of healthcare services and recent case-mix weights for IR, MH, CCC, and LTC residents.

Although we attempted to make this report comprehensive, there remain some lingering issues that need to be addressed. Whether to use hospital-specific or provincial unit costs in the analysis is one of them. Provincial average unit costs are more general and represent the cost of treatment for a “hypothetical” person. The choice of one versus the other should be motivated by the research objective. In particular, if research aims to answer a positive question that is not specific to a particular hospital or facility, such as for example COI in Ontario, then provincial unit costs should be used as they are more reflective of the average treatment costs in the province. Provider-specific unit costs need to be used if the research attempts to answer a normative question, for example in efficiency studies. Further, it is recommended to use facility-specific costs if the study is limited to a particular hospital or institution, since in this case facility-specific costs better reflect the actual care costs.

6.2 Future Work

This report summarizes progress to date in allocating health care system costs to individuals to enable person-level costing of healthcare resource consumption. There are many health care costs that are not attributable to individual utilization but there are also attributable costs that have not been allocated. The most substantive gap is ambulatory care in acute care hospitals such as specialist clinics. These costs amount to between 15 and 17% of acute care hospital costs. Future work should examine the potential of allocating these costs to individual patients based on physician billings and institutional codes included on those billings. Variability in costs across different clinics should be examined to determine whether an average cost per visit or a more specific approach is needed. Further refinements to primary care payments would also bring greater accuracy including accounting for charges to physicians when rostered patients visit physicians in other practices for in-basket services. Bonus and other non-FFS payments to physicians are also areas for further development.

7 Summary and Conclusions

In this report we describe methods to comprehensively allocate attributable costs to individuals in the health care system across all care sectors paid for by the MOHLTC or LHINs in the province of Ontario. It is believed that these methods also provide a useful template for other jurisdictions and payers. The report is intended to be useful to researchers and decision-makers and those responsible for tracking and managing healthcare system costs. There are still future improvements to be made to the methods including appropriately allocating ambulatory care costs incurred in acute care settings, additional APP physician payments, non-billed laboratory costs, and more specific algorithms that account for charge-backs to primary care physicians who receive capitation payments for in-basket services and whose patients travel outside of their groups to receive services (these latter services are paid for on a FFS basis by the MOHLTC and charged back to the primary care physicians with a number of limitations). As such our methods are often still approximations of actual costs incurred in the health care system – though we expect that they are very good approximations. As this is a work-in-progress, comments, corrections and suggestions are most welcome and should be directed by email to info@hsprn.ca.

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APPENDIX

Table 1. Summary of administrative claims databases and key variables used.

Database	Setting	Description	Key Variables	Validity
Ontario Registered Persons Database (RPDB)	General Population	The RPDB contains data on the vital status of all Ontario residents covered under OHIP.	<ul style="list-style-type: none"> • Demographic Variables • Eligibility for health benefits • Date of death 	<ul style="list-style-type: none"> • Captures all Ontario residents with a valid OHIP number • RPDB is not regularly updated, and individuals who move are often not recorded [27]. • Deaths in Ontario are incorporated from vital statistics data (with ~2 year time lag).
Discharge Abstract Database (DAD)	Acute Inpatient Hospitalizations	The CIHI DAD is a National database that contains demographic, clinical, and administrative data for inpatient hospital admissions. It contains over 1 million inpatient abstracts from 178 acute care facilities in Ontario [5].	<ul style="list-style-type: none"> • ICD-9-CA • ICD-10-CA • CCI and CCP • Resource Intensity Weight 	<ul style="list-style-type: none"> • Nearly 85% agreement between abstractor and most responsible diagnosis code [5]. • Median (IQR) kappa 0.81 (0.70 to 0.87), sensitivity 0.82 (0.71 to 0.89), and positive predictive value 0.82 (0.74 to 0.89) for inter-rater agreement on the top 50 most responsible diagnoses [5].
National Ambulatory Care Reporting System (NACRS)	Emergency, Day Surgery, and high-cost ambulatory treatments	The NACRS was fully developed in Ontario in 2002 and contains data for all ambulatory care including emergency department visits, outpatient clinics, and day surgery.	<ul style="list-style-type: none"> • ICD-9-CA • ICD-10-CA • CCI and CCP • Resource Intensity Weight 	<ul style="list-style-type: none"> • In reabstraction and inter-rater reliability studies, agreement rates in the selection of main problem was >85%, and >73% for reason for visit [28].
National Rehabilitation Reporting System (NRS)	Rehabilitation	The NRS contains National data on rehabilitation facilities and clients, collected from participating adult inpatient rehabilitation facilities and programs.	<ul style="list-style-type: none"> • Admission Date • Discharge Date • FIM Scores • Rehabilitation Client Group 	<ul style="list-style-type: none"> • All eligible rehabilitation facilities in Ontario are included; 100% response rate. Discharge record missing for 2.2% of Ontario episodes [29].

Continuing Care Reporting System (CCRS)	Complex Continuing Care	In 2004 the CCRS replaced the Ontario Chronic Care Patient System (OCCPS). CCRS contains clinical and demographic information on individuals receiving facility based continuing care. Services include medical LTC, rehabilitation, geriatric assessment, respite care, palliative care, and nursing home care. Patients are classified into 44 Resource Utilization Groups (RUGs), and are assigned a Case Mix Index (CMI) that approximates their per day resource usage. CMI is reviewed every quarter and can be adjusted multiple times.	<ul style="list-style-type: none"> • Admission Date • Discharge Date • Case Mix Index • Assessment Date 	<ul style="list-style-type: none"> • 12 out of 43 Minimum Data Set Resident Assessment Instrument (MDS) diagnoses attained a sensitivity of at least 0.80, including 7 of the 10 diagnoses with the highest prevalence as an acute care primary diagnosis before CCC admission. Despite this some MDS diagnoses had low sensitivity [30].
Ontario Mental Health Reporting System (OMHRS)	Mental Health	Starting October 1, 2005 Ontario Mental Health Reporting System (OMHRS) was implemented to assess persons in MH beds using Minimum Data Set for MH (MDS-MH) on admission, discharge, or every 92 days for persons with longer stays. Each inpatient is assigned a Case Mix Index (CMI) that approximates his/her per day resource use. CMI is reviewed every quarter and can be adjusted multiple times. Some MH cases are still in inpatient acute beds (DAD).	<ul style="list-style-type: none"> • Admission Date • Discharge Date • Case Mix Index • Assessment Date 	<ul style="list-style-type: none"> • Inter-rater reliability study found that almost all items on the RAI-MH had kappa value above 40%. [31] • Only about 15% of the items in RAI-MH instrument had kappas below 0.60 [32].

<p>Prior to 2003: Ontario Drug Benefit (ODB) For 2003-2010: Client Profile Database (CPRO) From 2010: Continuing Care Reporting System (CCRS)</p>	Long-Term Care	<p>Prior to 2003 admission date was determined as the first of a minimum of two consecutive LTC flags. Date of discharge was determined as two non LTC-flagged claims. Client Profile Database (CPRO) provides client's date of admission to LTC facility. In April 2010 MOHLTC moved to a new classification system based on Resource Utilization Groups (RUGs). LTC residents are classified into 34 RUGs, and the Ministry's per diem funding amount for the LTC home is adjusted for resident's acuity.</p>	<ul style="list-style-type: none"> • Admission Date • Discharge Date • Case Mix Index • Assessment Date 	<ul style="list-style-type: none"> • The Minimum Data Set Resident Assessment Instrument (MDS) demonstrates a reasonable level of consistency both in terms of how well MDS diagnoses correspond to hospital discharge diagnoses and in terms of the internal consistency of functioning and behavioral items. • The positive pressure ventilation (PPV) and sensitivity levels of Medicare hospital diagnoses and MDS based diagnoses were between 0.6 and 0.7 for major diagnoses like congestive heart failure (CHF), hypertension, and diabetes. • The MDS discharge tracking record should still not be used to indicate Medicare hospitalizations or mortality [33].
<p>Ontario Home Care Administrative System (OHCAS) and Home Care Database (HCD)</p>	Home Care	<p>The OHCAS and HCD provide data on government-funded services coordinated by Ontario's Community Care Access Centres (CCAC), for individuals requiring home care [34]. The HCD replaced the OHCAS in the 2005/2006 fiscal year.</p>	<ul style="list-style-type: none"> • Services Provided • Admission/ discharge date 	<ul style="list-style-type: none"> • All sites in all CCACs are represented • Valid health card numbers are not always available (e.g. homeless clients, disoriented or elderly persons) and therefore not all individuals in a cohort will be captured • Incomplete data for some regions.
<p>Ontario Health Insurance Plan (OHIP)</p>	Outpatient and Physician Services	<p>OHIP data cover all services and procedures provided by healthcare providers who can claim under OHIP (physicians, laboratory services)</p>	<ul style="list-style-type: none"> • Date of service • Fee Code • Fee Paid • Physician identifier 	<ul style="list-style-type: none"> • Approximately 95% of Ontario physicians have a fee for service or blended payment practice [35] and bill using the OHIP database.
<p>Ontario Drug Benefit (ODB) and New Drug Funding Program (NDFP)</p>	Prescription Drugs	<p>The ODB includes all drugs dispensed in community pharmacies and LTC/nursing facilities. The ODB covers all seniors in Ontario (aged 65+) and those on social assistance for all prescriptions listed in the provincial formulary. The NDFP provides coverage for high cost drugs for all ages.</p>	<ul style="list-style-type: none"> • Drug Identification Number (DIN) • Fee Paid by Ministry of Health • Long Term Care Indicator, Dispensing Fee, and Patient Copayment (ODB only) • Pharmacy identifier 	<ul style="list-style-type: none"> • Second largest prescription database in Canada. • At least 95% of seniors filled 1 medical prescription (Rx) in ODB over a 5 year period, however 15-20% filled a Rx from a private insurer [36]. • High coding reliability, overall error rate of 0.7% (95% CI 0.5%-0.9%) [37]. • Drugs dispensed during acute hospitalizations are not captured.

Assistive Devices Program (ADP)	Medical Devices	The ADP program captures amounts reimbursed to individuals based on claims for medical equipment (e.g. walkers, insulin pumps, continuous positive airway pressure devices).	<ul style="list-style-type: none"> • Device type • Reimbursement Paid by MOHLTC • Prescribing physician 	<ul style="list-style-type: none"> • Official recording of amounts paid by MOHLTC, limited use in research.
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Table 2. Historical unit costs by healthcare setting.

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Hospital Care										
Acute Care Cost Per Equivalent Weighted Case	\$3,771	\$4,184	\$4,350	\$4,286	\$4,966	\$5,118	\$5,268	\$5,825	\$5,631	\$5,675
Same Day Surgery Cost Per Weighted Case ⁴		\$4,031	\$4,388	\$4,373	\$5,858	\$5,295	\$5,213	\$5,763	\$6,142	\$5,874
Emergency Dept. Visit		\$4,320	\$4,373	\$4,523	\$4,937	\$4,834	\$4,900	\$5,591	\$6,057	\$5,588
Inpatient Rehabilitation Cost Per Weighted Case⁵	\$17,555	\$11,779	\$11,448	\$10,990	\$11,342	\$12,162	\$11,797	\$11,921	\$12,140	\$11,236
Complex Continuing Care Per Weighted Day	\$318	\$382	\$398	\$408	\$423	\$445	\$471	\$503	\$520	\$534
Long Term Care Per Diem	\$70.33	\$76.62	\$82.40	\$85.71	\$89.17	\$92.11	\$94.46	\$98.51	\$106.87	\$108.63
Nursing and Personal Care	\$53.48	\$59.81	\$63.84	\$68.19	\$70.52	\$73.69	\$75.07	\$77.32	\$79.60	\$86.05
Programming and Support Services	\$5.35	\$5.35	\$6.00	\$6.60	\$6.82	\$7.12	\$7.25	\$7.35	\$7.57	\$8.35
Raw Food	\$4.49	\$4.49	\$5.24	\$5.24	\$5.34	\$5.46	\$7.00	\$7.15	\$7.31	\$7.33
Other Accommodation	\$40.21	\$41.08	\$42.93	\$43.76	\$44.42	\$45.20	\$45.94	\$46.74	\$49.14	\$50.39
Home Care / CCAC Cost per Visit/Hour/Case by Service Type⁶										
Physiotherapy		\$95.80	\$97.25	\$99.61	\$108.49	\$111.37	\$108.62	\$112.07	\$117.66	\$117.59
Occupational therapy		\$108.70	\$108.06	\$109.51	\$120.22	\$119.06	\$123.13	\$132.41	\$139.10	\$139.98
Speech Language Therapy		\$119.40	\$112.00	\$112.62	\$124.69	\$125.16	\$142.07	\$148.13	\$158.58	\$158.26
Social work		\$138.40	\$134.46	\$137.20	\$147.83	\$143.79	\$155.01	\$166.41	\$185.25	\$177.25
Visiting Nursing		\$63.20	\$68.10	\$73.11	\$82.12	\$82.09	\$86.47	\$91.36	\$95.55	\$93.48
Shift nursing (per hour)		\$41.50	\$43.61	\$46.08	\$51.02	\$50.26	\$50.69	\$52.84	\$56.05	\$56.32
Dietary/nutrition		\$124.60	\$112.31	\$113.50	\$123.69	\$121.41	\$122.78	\$126.89	\$137.65	\$137.23
Homemaking / personal support (per hour)		\$25.40	\$25.27	\$25.92	\$30.48	\$29.78	\$30.44	\$31.87	\$32.93	\$33.00
Respite (per hour)			\$27.81	\$25.29	\$29.19	\$31.95	\$37.39 ⁷	\$36.38	\$35.84	\$35.97
Psychology					\$241.82 ⁸	\$93.83	\$97.01	\$99.49	\$88.54	\$88.54
Respiratory Services					\$366.67	\$282.56	\$247.93	\$324.15	\$223.31	\$564.44
Case Mgmt (per case)			\$490.1	\$481.9	\$519.8 ⁹	\$557.6	\$581.1	\$619.7	\$683.2	\$686.0

⁴ Until 2004, Same Day Surgery was bundled together with Acute Care.

⁵ Source: 2004/05 value came from JPPC Technical report, 2009/10 value was provided by Kevin Yu (MOH, Kevin.yu@ontario.ca). Values between 2004/05-2009/10 were obtained by interpolation, assuming constant growth rate; 2002/03 and 2003/04 estimated using the same growth rate as in Acute Care in the given years.

⁶ Source: <http://mohltcfm.com> (Path: Community Care Access Centers (CCAC) – CCAC MIS Comparative Reports). Alternatively, refer to [HOME CARE](#).

⁷ Data for 9 out of 14 LHIN is missing, thus this estimate is derived using an incomplete data.

⁸ Estimate is unreliable. Data on the total number of visits was missing for one of the CCACs.

⁹ This value was generated by taking the average between years 2005/06 and 2007/08.

Table 3. RIWs adjustment factors.

Age Groups	<p>CMG+ makes use of nine age groups. Neonate age groups are applied to Major Clinical Categories (MCC) 14 Newborn & Neonates. Paediatric and adult age groups are applied to most other MCC.</p> <p>Neonates:</p> <ul style="list-style-type: none"> ✓ Newborn ✓ Neonates 0 – 7 days (includes same day born and transferred) ✓ Neonates 8 – 28 days <p>Paediatric:</p> <ul style="list-style-type: none"> ✓ 29 – 364 days ✓ 1 – 7 years ✓ 8 – 17 years <p>Adult:</p> <ul style="list-style-type: none"> ✓ 18 – 59 years ✓ 60 – 79 years ✓ 80+ years
Flagged Intervention Categories	<p>Identifies interventions that are generally distributed across many MCC and that are associated with higher resource consumption cases, although the interventions themselves may not be costly. RIW, Expected Length of Stay (ELOS) and trim day estimates are adjusted to account for these interventions. These interventions are not used for CMG assignment, nor are they included on the CCI intervention partition list. There are currently 16 flagged intervention categories used in the CMG+ methodology. These include:</p> <ol style="list-style-type: none"> 1. Cardioversion 2. Cell Saver 3. Chemotherapy 4. Dialysis 5. Feeding Tubes (PEG) 6. Heart Resuscitation 7. Invasive (Mechanical) Ventilation >=96 Hours 8. Invasive (Mechanical) Ventilation <96 Hours 9. Non-invasive Biopsy 10. Paracentesis 11. Parenteral Nutrition 12. Per-Orifice Endoscopy 13. Pleurocentesis 14. Radiotherapy 15. Tracheostomy 16. Vascular Access Devices
Comorbidity Level	<p>Level 0 (0 - 24% impact on resource consumption)</p> <p>Level 1 (25 - 49% impact on resource consumption)</p> <p>Level 2 (50 - 74% impact on resource consumption)</p> <p>Level 3 (75 -124% impact on resource consumption)</p> <p>Level 4 (125+% impact on resource consumption)</p>

Source: CIHI. *CMG+ Tool Kit: Transitioning to the new CMG+ Grouping Methodology (and associated Health Resource Indicators)*. [38]

Table 4. Rehabilitation RPGs groups and 2010 RCWs values.

Rehabilitation Group	Rehabilitation Patient Group (RPG)	Rehab. Cost Weight (RCW)	Trim Point (days)	Rehab. Per Diem Weight
Stroke	1100. M=12-38 and Age=<68	2.7570	156	0.0366
Stroke	1110. M=12-38 and Age>=69	2.0340	120	0.0366
Stroke	1120. M=39-50	1.5061	103	0.0366
Stroke	1130. M=51-84 and C=5-25	1.1463	90	0.0366
Stroke	1140. M=51-84 and C=26-29	0.9356	67	0.0366
Stroke	1150. M=51-68 and C=30-35	0.7471	69	0.0366
Stroke	1160. M=69-84 and C=30-35	0.4950	55	0.0366
Traumatic Brain Injury	1200. M=12-13 and C=5-21	14.4249	307	0.0735
Traumatic Brain Injury	1210. M=14-47 and C=5-21	5.5779	226	0.0735
Traumatic Brain Injury	1220. M=48-84 and C=5-21	4.0197	171	0.0735
Traumatic Brain Injury	1230. M=12-44 and C=22-28	3.2043	136	0.0735
Traumatic Brain Injury	1240. M=45-84 and C=22-28	2.7211	96	0.0735
Traumatic Brain Injury	1250. M=12-84 and C=29-35	1.7140	96	0.0735
Non-Traumatic Brain Injury	1300. C=5-21	2.6513	149	0.0393
Non-Traumatic Brain Injury	1310. C=22-32 and Age=<61	1.6811	101	0.0393
Non-Traumatic Brain Injury	1320. C=22-32 and Age>=62	1.2175	82	0.0393
Non-Traumatic Brain Injury	1330. C=33-35	0.6931	75	0.0393
Neurological	1400. M=12-3	2.4631	171	0.0482
Neurological	1410. M=33-55	2.2709	115	0.0482
Neurological	1420. M=56-74	1.0531	92	0.0482
Neurological	1430. M=75-84	0.6497	78	0.0482
Traumatic Spinal Cord Injury	1500. M=12-16	17.8337	303	0.0875
Traumatic Spinal Cord Injury	1510. M=17-41 and Age< 30	10.4975	191	0.0875
Traumatic Spinal Cord Injury	1520. M=17-41 and Age >= 31	6.2115	174	0.0875
Traumatic Spinal Cord Injury	1530. M=42-84	1.8244	113	0.0875
Non-Traumatic Spinal Cord Injury	1600. M=12-28	4.2258	191	0.0443
Non-Traumatic Spinal Cord Injury	1610. M=29-54 and Age >=51	2.2882	135	0.0443
Non-Traumatic Spinal Cord Injury	1620. M=29-54 and Age<50	2.5724	127	0.0443
Non-Traumatic Spinal Cord Injury	1630. M=55-72	0.7843	91	0.0443
Non-Traumatic Spinal Cord Injury	1640. M=73-84	0.7413	78	0.0443
Amputation, Not Lower Extremity	1700. M=12-63	2.0950	85	0.0541
Amputation, Not Lower Extremity	1710. M=64-84	1.1219	85	0.0541
Amputation, Lower Extremity	1800. M=12-41	1.8482	142	0.0323
Amputation, Lower Extremity	1810. M=42-64	1.3942	102	0.0323
Amputation, Lower Extremity	1820. M=65-84 and C=5-31	1.1404	90	0.0323
Amputation. Lower Extremity	1830. M=65-84 and C=32-35	0.7760	77	0.0323
Osteoarthritis	1900. M=12-59	1.0662	65	0.0336
Osteoarthritis	1910. M=60-84	0.3558	28	0.0336

Rheumatoid arthritis and Other Arthritis	2000. M=12-68	1.1123	109	0.0383
Rheumatoid arthritis and Other Arthritis	2010. M=69-84	0.4919	39	0.0383
Pain	2100. M=12-68	0.5357	66	0.0298
Pain	2110. M=69-84	0.9776	55	0.0298
Fracture of Lower Extremity	2200. M=12-47 and Age >= 84	1.4685	105	0.0325
Fracture of Lower Extremity	2210. M=12-30 and Age<=83	1.9903	122	0.0325
Fracture of Lower Extremity	2220. M=31-47 and Age<=83	1.0942	88	0.0325
Fracture of Lower Extremity	2230. M=48-51	0.8950	83	0.0325
Fracture of Lower Extremity	2240. M=52-84 and Age >= 79	0.5583	68	0.0325
Fracture of Lower Extremity	2250. M=52-84 and Age <=78	0.4629	66	0.0325
Replacement of Lower Extremity	2300. M=12-53 and C=5-33	1.0032	84	0.0269
Replacement of Lower Extremity	2310. M=12-53 and C=34-35	0.5592	64	0.0269
Replacement of Lower Extremity	2320. M=54-68 and C=5-33	0.3736	50	0.0269
Replacement of Lower Extremity	2330. M=54-60 and C=34-35	0.3653	42	0.0269
Replacement of Lower Extremity	2340. M=61-68 and C=34-35	0.2429	34	0.0269
Replacement of Lower Extremity	2350. M=69-84	0.1658	29	0.0269
Other Orthopedic	2400. M=12-51 and C=5-33	1.6642	113	0.0378
Other Orthopedic	2410. M=12-51 and C=34-35	1.0566	93	0.0378
Other Orthopedic	2420. M=52-64 and C=5-33	0.8460	82	0.0378
Other Orthopedic	2430. M=52-64 and C=34-35	0.5832	82	0.0378
Other Orthopedic	2440. M=65-84	0.4109	50	0.0378
Cardiac	2500. M=12-49 and C=5-30	1.2374	88	0.0377
Cardiac	2510. M=12-49 and C=31-35	1.3400	78	0.0377
Cardiac	2520. M=50-67 and Age <= 82	0.6572	59	0.0377
Cardiac	2530. M=68-84 and Age<=82	0.3917	38	0.0377
Cardiac	2540. M=50-84 and Age>= 83	0.2945	46	0.0377
Pulmonary	2600. M=12-36 and Age >= 80	1.2467	84	0.0325
Pulmonary	2610. M=37-84 and Age >= 80	0.6472	67	0.0325
Pulmonary	2620. C=15-33 and Age <= 79	1.2547	92	0.0325
Pulmonary	2630. C=34-35 and Age <= 79	0.5643	72	0.0325
Burns	2700. M=12-84 and C=5-35	6.7501	134	0.1251

Major Multiple Trauma, Other Multiple Trauma & Major Multiple Fracture	2800. M=12-24	5.7445	150	0.0701
Major Multiple Trauma, Other Multiple Trauma & Major Multiple Fracture	2810. M=25-55 and Age <=24	1.6650	150	0.0701
Major Multiple Trauma, Other Multiple Trauma & Major Multiple Fracture	2820. M=25-48 and Age>= 25	3.5132	103.5	0.0701
Major Multiple Trauma, Other Multiple Trauma & Major Multiple Fracture	2830. M=49-55 and Age>= 25	2.0872	86	0.0701
Major Multiple Trauma, Other Multiple Trauma & Major Multiple Fracture	2840. M=56-84	1.2463	92	0.0701
Major Multiple Trauma with Brain or Spinal Cord Injury	2900. M=12-34	9.6570	179	0.0962
Major Multiple Trauma with Brain or Spinal Cord Injury	2910. M=35-59	3.9138	113	0.0962
Major Multiple Trauma with Brain or Spinal Cord Injury	2920. M=60-84	1.3648	113	0.0962
Ventilator Dependent Respiratory Disorders	3000. M=12-84 and C=5-35	4.3295	73	0.1589
Other Disabilities	3100. M=12-46	0.9135	106	0.0237
Other Disabilities	3110. M=47-58	0.5529	106	0.0237
Other Disabilities	3120. M=59-84 and Age <=58	0.6367	106	0.0237
Other Disabilities	3130. M=59-84 and C=5-33 and Age >= 59	0.3800	67	0.0237
Other Disabilities	3140. M=59-84 and C=34-35 and Age >= 59	0.2633	61	0.0237

Source: Sutherland JM. *Technical report: Evaluation and revision of the rehabilitation patient group (RPG) case mix system*. 2010.

Table 5. Complex Continuing Care RUG-III groups and 2010-2011 CMI values.

RUG-III (44-Group) Category		Rank	Name	CMI 2010
1. Special Rehabilitation	Ultra High	1	RUC	1.6952
		2	RUB	1.4004
		3	RUA	1.2415
	Very High	4	RVC	1.3243
		5	RVB	1.2497
		6	RVA	1.0584
	High	7	RHC	1.303
		8	RHB	1.139
		9	RHA	0.9813
	Medium	10	RMC	1.3324
		11	RMB	1.1268
		12	RMA	1.0165
	Low	13	RLB	1.0682
		14	RLA	0.7929
2. Extensive Care	15	SE3	1.3947	
	16	SE2	1.1412	
	17	SE1	0.9904	
3. Special Care	18	SSC	0.9531	
	19	SSB	0.8899	
	20	SSA	0.8518	
4. Clinically Complex Care	21	CC2	0.9642	
	22	CC1	0.8369	
	23	CB2	0.7768	
	24	CB1	0.7218	
	25	CA2	0.702	
	26	CA1	0.6273	
5. Impaired Cognition	27	IB2	0.5973	
	28	IB1	0.576	
	29	IA2	0.4874	
	30	IA1	0.4518	
6. Behaviour Problems	31	BB2	0.5888	
	32	BB1	0.5598	
	33	BA2	0.4729	
	34	BA1	0.4015	
7. Reduced Physical Function	35	PE2	0.6935	
	36	PE1	0.6786	
	37	PD2	0.6344	
	38	PD1	0.6187	
	39	PC2	0.572	
	40	PC1	0.5583	
	41	PB2	0.4239	
	42	PB1	0.4261	
	43	PA2	0.4064	
	44	PA1	0.3866	

Source: Canadian Institute of Health Information. *CCRS Technical Document—Ontario, RWPD Methodology*, 2010.

Table 6. Long-Term Care RUG-III groups and 2010-2011 CMI values.

RUG-III (34-Group) Category	Rank	Name	CMI 2010
1. Extensive Care	1	SE3	1.9422
	2	SE2	1.591
	3	SE1	1.446
2. Special Rehabilitation	4	RAD	1.6125
	5	RAC	1.3492
	6	RAB	1.1973
	7	RAA	1.0167
3. Special Care	8	SSC	1.402
	9	SSB	1.3189
	10	SSA	1.2135
4. Clinically Complex Care	11	CC2	1.3794
	12	CC1	1.277
	13	CB2	1.1905
	14	CB1	1.1161
	15	CA2	1.0683
	16	CA1	0.9413
5. Impaired Cognition	17	IB2	0.9729
	18	IB1	0.9469
	19	IA2	0.7561
	20	IA1	0.7177
6. Behaviour Problems	21	BB2	0.9388
	22	BB1	0.8917
	23	BA2	0.7036
	24	BA1	0.6327
7. Reduced Physical Function	25	PE2	1.1291
	26	PE1	1.1063
	27	PD2	0.9959
	28	PD1	0.9718
	29	PC2	0.9095
	30	PC1	0.8429
	31	PB2	0.7116
	32	PB1	0.7016
	33	PA2	0.6452
	34	PA1	0.6308

Source: Canadian Institute of Health Information. *CCRS Technical Document—Ontario RWPD Methodology*, 2010.

Table 7. DAD Case-Mix Groups (CMGs) for Mental Diseases and Disorders (MCC 19).

CMG2000	Years 2000-2009	CMG2007	Year 2010+
	Label		Label
764	depressive mood disorders with ECT	670	dementia
765	depressive mood disorders without ECT with Axis III	671	organic mental disorder
766	depressive mood disorders without ECT without Axis III	672	miscellaneous mental disorder
767	Depressive mood disorders LOS < 6 days	673	eating disorder
768	bipolar mood disorders, manic with ECT	674	puerperal disorder
769	bipolar mood disorders, manic without ECT with Axis III	675	other behavioural syndrome
770	bipolar mood disorders, manic without ECT without Axis III	676	schizophrenia with ECT
771	Bipolar mood disorders LOS < 6 days	677	676 w/o ECT
772	dementia w or w/o delirium with Axis III	678	schizotypal/delusional disorder
773	dementia w or w/o delirium without Axis III	679	schizoaffective disorder with ECT
774	organic mental disorders induced by drugs	680	679 w/o ECT
775	schizophrenia etc with ECT	681	gender identity/sexual preference disorder
776	schizophrenia etc w/o ECT	682	habit/impulse disorder
777	schizophrenia etc w/o ECT or Axis III	683	disorder of adult personality behaviour
778	schizophrenia etc LOS < 6 days	684	OCD
779	dissociative disorders	685	somatoform/dissociative disorder
780	ETOH induced organic mental disorder with Axis III	686	anxiety disorder
781	780 without Axis III	687	stress reaction/adjustment disorder
783	psychoactive substance dependence	688	bipolar with ECT
784	psychoactive substance abuse	689	688 w/o ECT
785	developmental delay	690	bipolar, severe depression with ECT
786	disruptive behaviour disorders	691	690 w/o ECT
787	eating disorders	692	depressive episode with ECT
788	organic mental disorders associated w physical disorders w/ Axis III	693	692 w/o ECT
789	788 w/o Axis III	694	mood (affective) disorder
790	somatoform disorders	695	MR/disorder of development
791	anxiety disorders (MNRH)	696	childhood/adolescence disorder
792	adjustment disorders (MNRH)	697	mixed disorder of conduct/emotion psychoactive substance use, acute intoxication
793	Personality disorders with Axis III (MNRH)	698	psychoactive substance use, harmful use
794	793 w/o Axis III (MNRH)	699	psychoactive substance use, dependence syndrome
795	sexual dysfunction and sexual disorders (MNRH)	700	psychoactive substance use, withdrawal state
796	specific developmental disorders (MNRH)	701	psychoactive substance use, withdrawal/delirium
797	miscellaneous psychiatric diagnoses (MNRH)	702	psychoactive substance use, residual/late-onset/psychotic disorder
909	obsolete psychiatric diagnoses (MNRH)	703	psychoactive substance use, amnesic/other/unspec.
		704	
		778	poisoning/toxic effect of drug

Table 8.1 Monthly Comprehensive Care Capitation Base Payment levels

Date	Monthly Base rate (first 12 months)	After 12 months on roster
October 1, 2005 – December 31, 2008	\$1.42	\$1.80
January 1, 2009 – September 30, 2009	\$1.50	\$2.15
October 1, 2009 – September 30, 2010	\$1.57	\$2.25
October 1, 2010 – August 31, 2011	\$1.64	\$2.35
September 1, 2011 – current*	\$1.73	\$2.48

*November 2012. Updates continue.

Table 8.2. Comprehensive Care Capitation Monthly Rates

	Comprehensive Care	Rates
Age Category	Male	Female
00-04	1.06	1.01
05-09	0.56	0.54
10-14	0.44	0.46
15-19	0.46	0.82
20-24	0.46	1.04
25-29	0.50	1.08
30-34	0.58	1.08
35-39	0.72	1.17
40-44	0.80	1.20
45-49	0.88	1.30
50-54	1.02	1.46
55-59	1.16	1.47
60-64	1.27	1.51
65-69	1.44	1.59
70-74	1.67	1.70
75-79	2.01	2.03
80-84	2.11	2.10
85-89	2.35	2.39
90+	2.65	2.70

Table 8.3 Annual Base Rate for FHN and FHO Capitation Models

Date	FHO Base rate	FHN Base rate
May 1, 2005 - September 30, 2005	\$116.58	N/A
October 1, 2005 - March 31, 2006	\$118.52	N/A
April 1, 2006 - June 30, 2006	\$119.71	N/A
July 1, 2006 - September 30, 2006	\$119.71	N/A
October 1, 2006 - December 1, 2006	\$121.49	\$110.01
January 1, 2007 - March 31, 2007	\$122.25	\$110.74
April 1, 2007 - December 31, 2007	\$123.44	\$111.84
January 1, 2008 – September 30, 2009	\$124.63	\$112.94
October 1, 2009 – September 30, 2010	\$130.61	\$117.91
October 1, 2010 – August 31, 2011	\$132.82	\$119.90
September 1, 2011 – (current)*	\$140.12	\$126.50

* current is November 2012. Updates continue.

Table 8.4 Base rate multiplier for FHO and FHN Capitation Models

	FHO	Rates		FHN	Rates
Age Category	Male	Female	Age Category	Male	Female
00-04	1.03	0.98	00-04	1.06	1.01
05-09	0.55	0.54	05-09	0.55	0.54
10-14	0.44	0.46	10-14	0.44	0.46
15-19	0.47	0.81	15-19	0.46	0.82
20-24	0.46	1.01	20-24	0.46	1.04
25-29	0.50	1.05	25-29	0.50	1.07
30-34	0.58	1.05	30-34	0.58	1.08
35-39	0.71	1.14	35-39	0.72	1.17
40-44	0.80	1.18	40-44	0.80	1.20
45-49	0.87	1.29	45-49	0.88	1.30
50-54	1.01	1.44	50-54	1.02	1.46
55-59	1.15	1.46	55-59	1.16	1.48
60-64	1.27	1.49	60-64	1.28	1.51
65-69	1.43	1.58	65-69	1.44	1.59
70-74	1.67	1.71	70-74	1.67	1.70
75-79	2.04	2.08	75-79	2.01	2.03
80-84	2.21	2.28	80-84	2.10	2.10
85-89	2.65	2.81	85-89	2.35	2.39
90+	3.34	3.57	90+	2.65	2.71

Table 8.5 Senior Care Premium Multiplier for FHO Capitation Models

Age	Male	Female
65-69*	0.20	0.22
70-74	0.23	0.23
75-79	0.28	0.28
80-84	0.29	0.29
85-89	0.32	0.33
90+	0.37	0.37

*Effective January 1, 2008. No senior care premium for ages 65-69 prior to January 1, 2008.

Table 8.6 Senior Care Premium Multiplier for FHN Capitation Models

Date	Senior Care Premium Multiplier
October 1, 2005 – December 31, 2008	0.15*
January 1, 2009 – thereafter	0.15*

*Prior to January 1, 2009 senior care premium multiplier was applied to ages 70+, after January 1, 2009, the premium is applicable to all persons aged 65+

Source Documents for Tables 8.1-8.6:

25. Ministry of Health and Long Term Care, *Family Health Teams: Guide to Physician Compensation*, v3.0. September 2009, Queen's Printer for Ontario: Toronto.

Family Health Network, Ministry of Health and Long Term Care General blended payment template. Family Health Network agreement. Toronto, ON: Ministry of Health and Long Term Care; 2006.

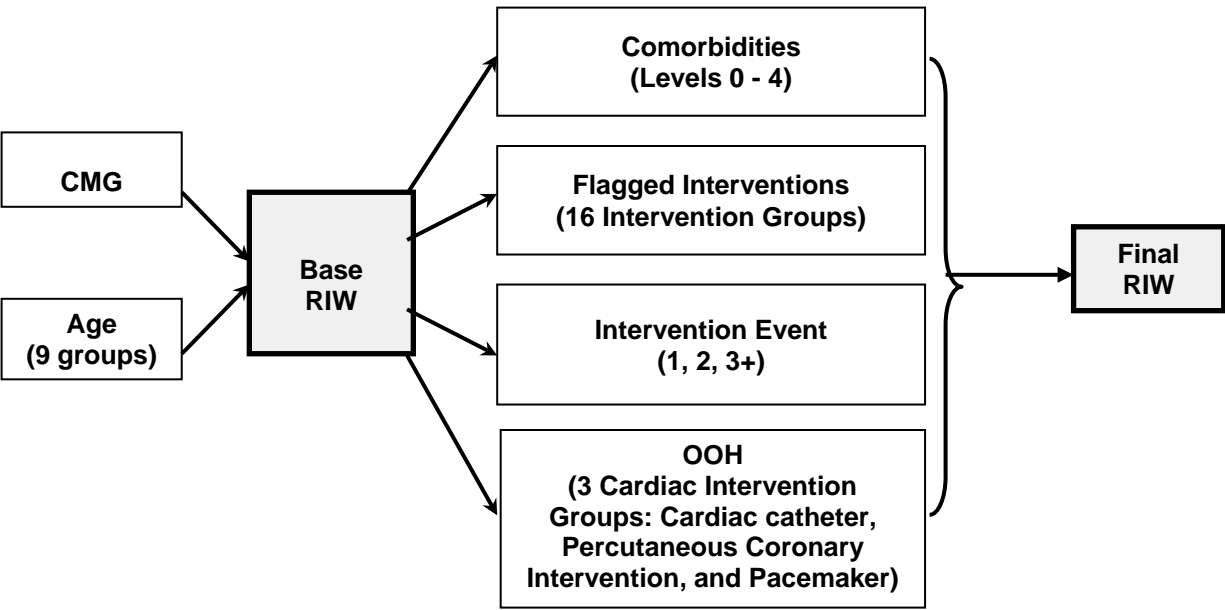
Table 9. Historic CPI and inflation rate for healthcare, medicinal and pharmaceutical products and healthcare services in Ontario.

Year	Province	Health care		Medicinal and pharma products		Health care services		Health care goods	
		CPI Value	Inflation Rate (% change in CPI)	CPI Value	Inflation Rate (% change in CPI)	CPI Value	Inflation Rate (% change in CPI)	CPI Value	Inflation Rate (% change in CPI)
1990	Ontario	76.5	5.96%	82.2	5.79%	68	6.25%	86.1	0.058
1991	Ontario	80.6	5.36%	86.6	5.35%	71.8	5.59%	90.4	0.050
1992	Ontario	83.2	3.23%	88.6	2.31%	75.6	5.29%	91.7	0.014
1993	Ontario	85.5	2.76%	90.9	2.60%	78.5	3.84%	93.2	0.016
1994	Ontario	86.6	1.29%	91.2	0.33%	80.8	2.93%	92.9	-0.003
1995	Ontario	86.7	0.12%	90.5	-0.77%	81.7	1.11%	91.9	-0.011
1996	Ontario	87.4	0.81%	90.7	0.22%	82.9	1.47%	92.1	0.002
1997	Ontario	88.6	1.37%	90.5	-0.22%	84.9	2.41%	92.4	0.003
1998	Ontario	90.7	2.37%	92.5	2.21%	87.4	2.94%	94	0.017
1999	Ontario	93.2	2.76%	95.4	3.14%	90.7	3.78%	95.8	0.019
2000	Ontario	95.2	2.15%	97.8	2.52%	93.1	2.65%	97.3	0.016
2001	Ontario	97.9	2.84%	100.3	2.56%	96.4	3.54%	99.4	0.022
2002	Ontario	100	2.15%	100	-0.30%	100	3.73%	100	0.006
2003	Ontario	102	2.00%	100	0.00%	103.8	3.80%	100.3	0.003
2004	Ontario	103.9	1.86%	99.8	-0.20%	107.8	3.85%	100.3	0.000
2005	Ontario	107.8	3.75%	100.2	0.40%	114.8	6.49%	101.5	0.012
2006	Ontario	110.4	2.41%	100.8	0.60%	118.5	3.22%	103	0.015
2007	Ontario	112.9	2.26%	101.4	0.60%	121.9	2.87%	104.8	0.017
2008	Ontario	114.9	1.77%	101.8	0.39%	124.6	2.21%	106	0.011
2009	Ontario	117	1.83%	103.8	1.96%	126.8	1.77%	108	0.019
2010	Ontario	118.5	1.28%	103.9	0.01%	130.1	2.60%	108.0	0.00%
2011	Ontario	120.2	1.43%	103.9	0.00%	133.0	2.23%	108.8	0.74%
2012	Ontario	120.1	-0.08%	101.3	-2.50%	135.8	2.11%	106.6	-2.02%

Source: Statistics Canada. CANSIM Table 326-0021.

<http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id260021&tabMode=Table&srchLan=-1&p1=-1&p2=9>

Figure 1. Contribution of the CMGs and other factors to the RIWs.



Source: CIHI. *CMG+ Tool Kit: Transitioning to the new CMG+ Grouping Methodology (and associated Health Resource Indicators)*. [38]

Figure 2. Change of CMI over time for a hypothetical person admitted to CCC, LTC or Inpatient MH.

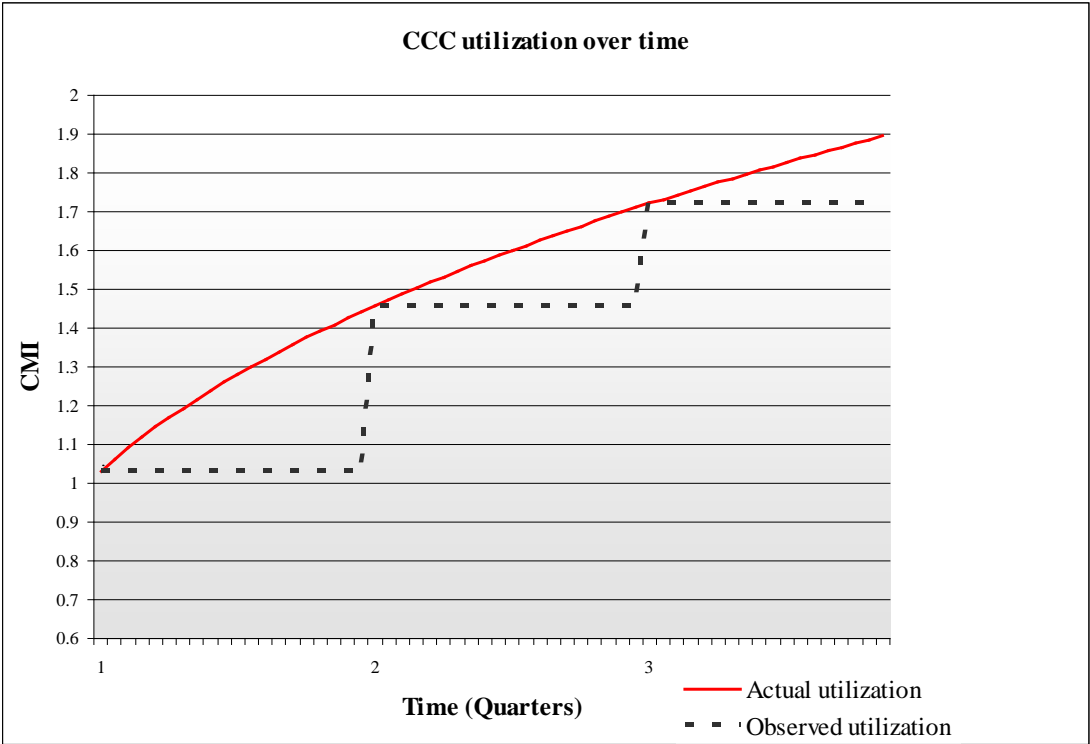


Figure 3. Outline of MDS-MH assessment schedule.

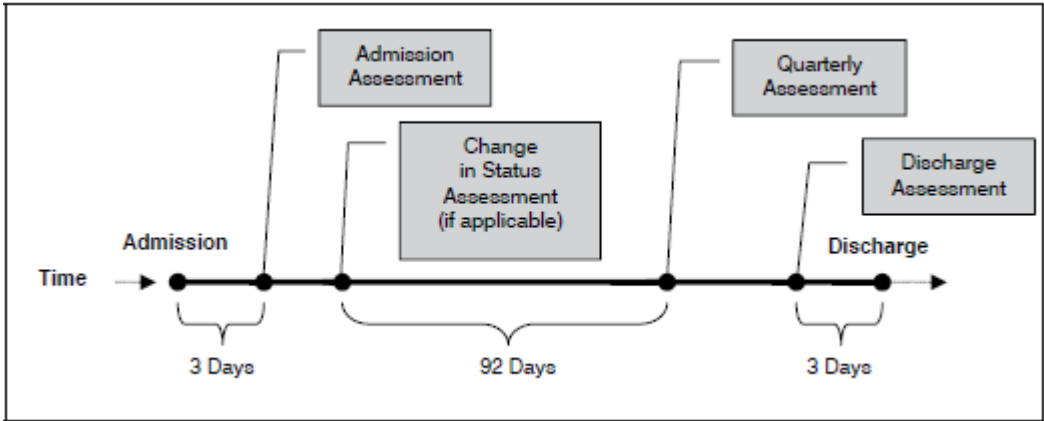
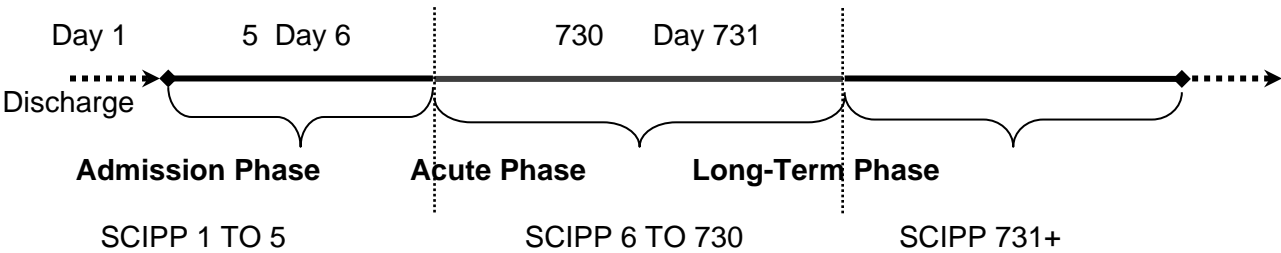


Figure 4. Resource Phases and SCIPP Groups.



Source: CIHI. *Ontario Mental Health Reporting System Data Quality Documentation, 2009-2010*. [39]

**Guidelines on Person-Level Costing Using Administrative Databases in Ontario.
Working Paper Series. Vol 1. Toronto: Health System Performance Research Network;
2013.**

This report is available at the Health System Performance Research Network Website:
<http://hsprn.ca>.

For inquiries, comments and corrections please email info@hsprn.ca.