HSPN Population Segmentation

Technical Report

Luke Mondor
Ruth E. Hall
Walter P. Wodchis

March 2022

HSPN Health System Performance Network

About Us

The Health System Performance Network (HSPN) is a collaborative network of investigators, visiting scholars, post-doctoral fellows, graduate students and research staff working with health sys-tem leaders, and policymakers to improve the management and performance of our health system. Building on Ontario's established record of performance measurement created by the 1998 ground-breaking Hospital Report Research Collaborative, the HSPN was established in 2009 and has built a track record in performance measurement, research, evaluation and improvement in Ontario with expertise in multiple domains of health system performance including perspectives of patients, providers, population health, and cost. The HSPN receives funding from the Ontario Ministry of Health.

Contact information

Health System Performance Network
155 College Street, Suite 425
Toronto ON M5T 3M6
Telephone: +1 (416) 946-5023
Email: hspn@utoronto.ca

Authors Affiliations

Luke Mondor, MSc – HSPN and ICES

Ruth E. Hall, PhD – HSPN, University of Toronto; Institute for Better Health, Trillium Health Partners; and ICES

Walter P. Wodchis, PhD – HSPN, University of Toronto; Institute for Better Health, Trillium Health Partners; and ICES

Financial Support

This research was supported by a grant from the Ontario MOH to the HSPN. The funders had no role in data analysis, decision to publish, or preparation of the report.

Suggested citation

Mondor L, Hall RE, & Wodchis WP. HSPN Population Segmentation: Technical Report. Toronto, ON: Health System Performance Network. 2022.

ISBN 978-1-990477-05-8 (Online)

This document is available at hspn.ca.

Contents

Abbreviations

BCHSM	British Columbia Health System Matrix
CAPE	Client Agency Program Enrolment database
CCC	Complex Continuing Care database
CCI	Canadian Classification of Health Interventions
CCP	Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures
CCRS	Continuing Care Reporting System database
CHC	Community Health Centre database
CIHI	Canadian Institute for Health Information
cQIP	collaborative Quality Improvement Program
DAD	Discharge Abstract Database
ED	Emergency department
ESTSOB	Estimated Schedule of Benefits
FFS-CCM	Fee-For-Service Comprehensive Care Model
FHG	Family Health Groups
FHN	Family Health Networks
FHO	Family Health Organizations
FHT	Family Health Team
GAPP	GAPP Decision Support Systems
HCD	Home Care Database
Hosp	Hospitalization
HSPN	Health System Performance Network
ICD	International Classification of Diseases
interRAIHC	inter Resident Assessment Instrument for Home Care database
LTC	Long-term care
MDSHSI	Minimum Dataset Health Status Index
MHA	Mental health and addictions
MOH	Ministry of Health
NACRS	National Ambulatory Care Reporting System database
NRS	National Rehabilitation Reporting System database
OBSP	Ontario Breast Screening Program database
OCCI	Ontario Case Costing Initiative database
OCR	Ontario Cancer Registry database
ODB	Ontario Drug Benefits claims database
OHIP	Ontario Health Insurance Program claims database / physician encounters
OHCAS	Ontario Home Care Administrative System database
OHT	Ontario Health Team
OHTAM	Ontario Health Team Attribution Model database
OMHRS	Ontario Mental Health Reporting System database
PEM	Patient Enrolment Model
PGLO	Provincial Geriatrics Leadership Office of Ontario
PS	Population segment
QIP	Quality Improvement Plan

RAICA	Resident Assessment Instrument Contact Assessment database
RAIHC	Resident Assessment Instrument for Home Care database
RPDB	Registered Persons Database
SDS	Same Day Surgery database
UPC	Usual provider of care

Purpose of this Report

This technical report accompanies population segmentation and Health System Performance Network (HSPN) improvement indicators that were distributed in the winter of 2022 to each Ontario Health Team with comparative provincial results made available on the HSPN OHT evaluation website (and shared in the January 25th, 2022 HSPN Webinar). These reports build on prior HSPN improvement indicator reports that were distributed to each OHT and reported provincially in May and June of 2021 [1-4]. The 2021 reports provided results for each OHT on 25 Improvement indicators: ten for the overall OHT population and five for each of three focus areas including mental health and addictions, frail older adults, and palliative / end of life populations. The 2021 reports also reported on the ratio of each indicator in the highest quintile of material deprivation compared to the lowest quintile of material deprivation.

For 2022, the HSPN has created a data package with three Excel spreadsheets. These Excel spreadsheets included results for 25 indicators identified by the original reports supplemented by three new cancer screening indicators. The new cancer screening indicators were identified by Ontario Health as part of a set of five collaborative Quality Improvement Program (cQIP) indicators. The other two indicators were for indicators included in our original 25, namely Alternate Level of Care (ALC) days and presentations to Emergency Departments (ED) as the first source of mental health and addictions care (based on physician billings and hospital presentations). There are also worksheets included that report on contextual measures of the total number of physician visits, the number and proportion of physician visits that were to primary care, and the proportion of physician visits to specialist physicians.

In the first spreadsheet, all indicators are reported according to the British Columbia Health System Matrix (BCHSM) population segments and by Material Deprivation quintile. Data are also provided for Material Deprivation quintiles 1-3 and 4-5 combined.

In the second spreadsheet all indicators are reported according to the Canadian Institute for Health Information (CIHI) Population Grouping Methodology segments and by Material Deprivation quintile. Data are also provided for Material Deprivation quintiles 1-3 and 4-5 combined.

A third spreadsheet includes all indicators reported by primary care Patient Enrolment Model (PEM).

A fourth file provided a PowerPoint presentation of selected cQIP indicators according to BCHSM population segments, Material Deprivation, primary care PEM and according to CIHI Population Grouping Methodology population segments.

The purpose of this report is to outline the methodology used to create the BCHSM population segments, Material Deprivation quintiles, and primary care PEMs. The CIHI Population Grouping Methodology categories were obtained from existing health administrative data and the reader is referred to CIHI for details for that system.

1.0 – A Brief Primary on Using Population Segmentation for Population Health Management

The goal for population health management is to improve the health of the population which means increasing overall health and reducing inequalities in health outcomes [5]. One of the very first steps in population health management is to use available health data to segment the population into groups of individuals with similar health-related needs. The HSPN produced a series of three white papers on population health management and population segmentation using an international review of existing approaches [6-8]. Key conclusions of these reports were:

- Population segmentation is an essential tool to be able to match patient needs with suitable interventions.
- Population segmentation should aim to be inclusive of the entire population and therefore to use data that are as inclusive as possible for the entire population.
- In order to use population segmentation in the design and implementation of interventions, segments need to be clinically meaningful and interpretable at the front lines of care.
- There is no single gold standard for population segmentation: some form of segmentation is essential, the exact approach should support the achievement of goals and priorities in the local implementation of population health management.
- Three broad approaches to population segmentation include:
  1) risk-oriented models which aim to predict which individuals will require high cost and high-intensity services in the year future;
  2) clinically-oriented models which identify the types of care needs experienced by patients; and
  3) data driven approaches which aim to identify clusters of conditions that tend to accompany each other.
- HSPN should support Ontario Health Teams (OHTs) seeking to implement population health management with each of the first two broad approaches and work to determine suitability and usefulness of each approach.

The present set of data packages pick up where the previous series of white papers left off, bolstered by the new availability of 28 improvement indicators selected for early OHT implementation. Segmenting the population and then examining improvement indicators within population segments is aimed to further refine understanding the characteristics of individuals who contribute to lower scores on improvement indicators.

1.1 – How to Use HSPN Population Segmentation to Focus Improve Health Outcomes Measured by Improvement Indicators: An example using collaborative Quality Improvement Indicators

The PowerPoint presentations report on five cQIP improvement indicators as an example of how to use the data in the accompanying Excel spreadsheets to inform improvement ideas. In reviewing these data, we have identified a few common patterns across the different cQIP indicators. For example, while ALC is a well-known indicator for all OHTs, the BCHSM segments identify that there are a proportion of individuals in ALC who have palliative care needs, another group who are frail with complex medical needs and aim to be transitioned to the community, and another group that hold spaces/beds in long-term care homes. The interventions and pathways for these groups may differ based on the availability of resources and intended goals of care. In contrast, most individuals who are behind on screening for breast, colorectal or cervical cancers are relatively healthy individuals, many of whom have not had any encounter in the health system in the prior year. Interventions here require that OHTs both use contacts with the health system to remind individuals to have cancer screening tests but also require that OHTs find ways to reach out to patients who are not using the health care system.

We also use segments according to material deprivation to identify which indicators there may be additional socio-economic challenges to overcome in order to make advances in indicator scores. Cancer screening indicators for example show significant gradients where individuals living in areas with high levels of material deprivation are less likely to have completed recommended screening as compared to individuals living

in areas with low levels of material deprivation. When considering the cQIP indicator for presentations to ED as the first source of mental health and addictions care (based on physician billings and hospital presentations), the data generally indicate at the provincial level (which tends to be mirrored in individual OHT results), that individuals living in areas with high material deprivation tend to have higher rates of ED visits for mental health and addictions causes but that these are equally likely to be the first presentation across all levels of material deprivation. Hence, it is primarily the preventative screening indicators where interventions may need to provide special consideration for individuals in areas of high material deprivation.

Ontario's primary care system has a wide variety of PEMs that represent different physician funding methods and enhanced team-based resources. There are several models that provide patient rostering that represents an agreement between patients and physicians to have a priority if not entirely exclusive primary care relationship. Within rostered models, physicians may be paid primarily through Fee-For-Service (Comprehensive Care Model – FFS-CCM), primarily through capitation (Family Health Organizations and Family Health Networks – FHO/FHN), or through blended payment (Family Health Groups – FHG). Some FHO/FHN providers are also affiliated with Family Health Teams (FHTs) which enables access to additional interprofessional health care team resources. The cQIP cancer screening indicators demonstrate a consistent relationship with the patient's PEM where patients enrolled to FHT models achieving rates of screening that are as much as 10% higher than patients who are not rostered.

The CIHI Population Grouping Methodology provides results that have similarities to those of the BCHSM (for example, the largest screening opportunities amongst those with few or no health conditions or who did not access health care). There are differences between the BCHSM and CIHI Population Grouper because of definitional differences. The palliative population for example is smaller in the CIHI system because fewer community-based patients with palliative care needs are identified in the CIHI system. The CIHI system also does not consider individuals living in long-term care facilities separate from community-dwelling individuals, and the CIHI system also does not have a frailty modifier included in the characterization of population health needs (associated individuals with dementia, for example, are captured in major mental health). The CIHI grouper, however, provides distinctions between minor and major acute, minor and major cancers, and has three levels of chronic condition severity.

We have provided examples here using five cQIP indicators. It is intended, however, that OHTs are able to use the data in the Excel spreadsheets to undertake an equivalent analysis for any indicator(s) within the 28 supplied indicators to further understand sources of variation and focus populations that represent opportunities for improvement on any of the associated indicators. Some of the most common indicators identified by OHTs include frequent ED visits, ambulatory-care sensitive hospitalizations and physician follow-up after hospital discharge. A similar analysis as presented in the associated PowerPoint slide deck could be undertaken by OHTs given the data supplied in the Excel files.

2.0 – The British Columbia Health System Matrix

Summary

The BCHSM is a population segmentation approach that divides the entire population into 14 mutually exclusive population segments (PS) ranging from *Healthy* (lowest health care needs) to *End of Life* (greatest health care needs). An individual can meet the definition for multiple segments but are assigned to the segment that represents their greatest need in that year. Specifically, the BCHSM places individuals in the category with the highest expected clinical complexity ranked in descending order as PS14 to PS01 (where PS represents Population Segment). An individual living in long-term care with palliative care needs will be associated with the palliative care group, an individual with advanced cancer who is living in long-term care facility will be identified in the long term care group, and so forth.

The BCHSM was inspired from the Bridges to Health model [9], which divides a population into eight mutually exclusive groups including healthy, maternal and infant health, acutely ill, chronic conditions, stable but serious disability, short period of decline before dying, limited reserve and exacerbations, and frailty. Each group has their own definitions for optimal health and priorities for care and it is proposed that addressing the needs of these segments leads to more efficient and reliable health care supporting improvement of health across the entire population.

The following table identifies the 14 segments in the BCHSM. Definitions for Ontario health administrative data are in the following section.

Table 1. The 14 Segments of the British Columbia Health System Matrix

Category	No	Definition
Towards the End of Life	PS14	End of Life – People who received any health care services specifically for palliative care in the prior year.
Towards the End of Life	PS13	Frail in Care – Residents of long-term care facilities that provide 24-hour nursing care and assistance with Activities of Daily Living (ADL) in the prior year.
Living with Illness	PS12	Cancer – People diagnosed with cancer in the prior two years.
Towards the End of Life	PS11	Frail with High Complex Chronic Conditions – People 40 years of age or older and have one or more high chronic conditions such as Alzheimer's disease or other dementia, cystic fibrosis, heart failure, organ transplant, have had a stroke, are on dialysis, or have a specific combination of chronic conditions and either had dementia or had two or more of the seven following conditions: cognitive impairment, incontinence, falls, nutritional difficulties, functional difficulties, targeted health service utilization or decline in general health status.
Living with Illness	PS10	High Complex Chronic Conditions – People with one or more high chronic conditions such as cystic fibrosis, heart failure, organ transplant, have had a stroke, are on dialysis, or have a specific combination of chronic conditions.
Towards the End of Life	PS09	Frail in the Community – Community dwelling people who had two or more of the seven following conditions: cognitive impairment, incontinence, falls, nutritional difficulties, functional difficulties, targeted health service utilization or decline in general health status.
Staying Healthy	PS08	Maternity and Healthy Newborns – Women who are pregnant or delivered a baby in the prior year, and their healthy newborns.
Living with Illness	PS07	Mental Health and Substance Use – People who experience severe mental disorders (including substance use disorders) in the prior five years.
Living with Illness	PS06	Medium Complex Chronic Conditions – People in this population segment have one or more medium chronic conditions such as angina, COPD, multiple sclerosis, Parkinson's, pre-dialysis chronic kidney disease, rheumatoid arthritis, have had a major cardiac event or intervention, or have a specific combination of chronic conditions.
Living with Illness	PS05	Low Complex Chronic Conditions – People in this population segment have one or more low complex chronic conditions, such as asthma, mood, or anxiety disorder including depression, diabetes, epilepsy, hypertension, osteoarthritis, or osteoporosis.
Getting Healthy	PS04	Child and Youth Major <18 years – Residents who are under 18 years old with major health conditions that were not identified in other population segments.
Getting Healthy	PS03	Adult Major Age 18+ – Residents who are 18 years old or older with major health conditions that are not identified in other population segments.
Staying Healthy	PS02	Healthy – Residents who are low users of publicly funded services, and do not have any of the health conditions that are identified in the other population segments.
Staying Healthy	PS01	Non-Users – Residents who do not use any of the public health services included in Health System Matrix.

2.1 – Segment Technical Definitions for the BC Health System Matrix

PS14 – End of Life	
Definition:	People who received any health care services specifically for palliative care in the prior year.
Data Sources:	CCRS, DAD, HCD, interRAIHC, NACRS, NRS, OHIP, OMHRS, RAICA, RAIHC
Codes/Algorithms Used:	Individuals were included in PS14 if they had any of the following codes assigned in the prior year:

Dataset	Codes Used
OHIP	FEECODES = A945, B966, B997 (after Oct 2009), B998, C882, C945, C982, G511, G512, K015, K023, K700, W872, W882, W972, W982
DAD	DXCODE[1-16] = V667 regardless DXPREF DX10CODE[1-25] = Z515 regardless DXPREF PATSERV = 58 PRVSERV[1-8] = 00121 INSERV[1-20] = 00121 CMG20XX = 810 TRNSERV[1-3] = 58
NACRS	PRVSERV[1-10] = 00121 CONSULTSERV[1-3] DX10CODE[1-25] = Z515
RAICA	B2C = 1 B4 = 12 E7 = 2
RAIHC	CC3F = 1 P2S = 1 or 2 K8E = 1 CAP_PALLIATIVE_CARE = 5 or 6 CAP_PALLIATIVE_CARE_ACTION = 1
interRAIHC	J6C = 1 N2M = 2 or 3
HCD – Clients	SRC_ADMISSION = 95 RESIDENCE_TYPE = 2000 SRC_DISCHARGE = 54 or 95
HCD - Services	SERVICE_RPC = 54 or 95 SERVICE = 17
CCRS - CCC	P1AO = 1 J5C = 1 K2A = 248
CCRS - LTC	P1AO = 1 J5C = 1 K2A = 248
NRS	ADMICD10CODE DHCICD10CODE [01-15]
OMHRS	DISCHLIVING = 11

Notes and Limitations:	• Code set adapted from Tanuseputro P, *et al*. (2017) *Palliative care delivery across health sectors: a population-level observational study.* Palliat Med; 31(3): 247-257 and endorsed by lead authors.

PS13 – Frail in Residential Care

Definition:	Residents of long-term care facilities that provide 24-hour nursing care and assistance with Activities of Daily Living (ADL) in the prior year
Data Sources:	CCRS, ODB, OHIP
Codes/Algorithms Used:	Individuals were included in PS13 if they had any of the following codes assigned in the prior year:

Dataset	Codes Used
OHIP	FEECODES starting with 'W' LOCATION = L
ODB	LTC = 1
CCRS - LTC	Any admission

Notes and Limitations:	N/A

PS12 - Cancer

Definition:	People diagnosed with cancer in the prior two years.
Data Sources:	OCR
Codes/Algorithms Used:	Individuals were included in PS12 if, in the prior 2 years, they entered the Ontario Cancer Registry with a new diagnosis of cancer.
Notes and Limitations:	N/A

PS11 – Frail with High Complex Chronic Conditions

Definition:	People in this population segment are 40 years of age or older and meet the Provincial Geriatrics Leadership Office of Ontario (PGLO) frailty definition (either had dementia or had two or more of the seven following conditions: cognitive impairment, incontinence, falls, nutritional difficulties, functional difficulties, targeted health service utilization or decline in general health status) AND have previously been diagnosed with one or more high chronic conditions (any of Alzheimer's disease or other dementia, cystic fibrosis, heart failure, organ transplant, have had a stroke, are on dialysis, or have a specific combination of chronic conditions).
Data Sources:	CCRS - LTC, DAD, HCD, NACRS, ODB, OHIP, RAICA, RAIHC, RPDB, SDS

Codes/Algorithms Used:	Frailty includes all persons:
	• With a history of dementia (see Jaakkimainen RL, *et al*. (2016) *Identification of physician-diagnosed Alzheimer's disease and related dementias in population-based administrative data: a validation study using family physicians' electronic medical records*. Journal of Alzheimer's Disease, 54: 337-349 for codes),
	OR
	• With two or more of the following seven conditions identified in DAD or OHIP:
	  • Cognitive impairment, including dementia and delirium (ICD-10 codes F05X: F050, F051, F058, F059 and ICD-9 codes 293)
	  • Incontinence (ICD-10: R32, R15),
	  • Falls (ICD-10: E9177, E9178, E9293, W01,W05-W19)
	  • Nutritional difficulties (ICD-10: R627, R634, R633, R630, F500, F501, R63, R636, R638,78322, 7833, 7839),
	  • Functional difficulties (ICD-10: R26, R262, M6250-9, M6281, L89X)
	  • Targeted health service utilization (OHIP specialty 07 with OHIP feecodes W770, W775, W795, A770, A775, A795, C770, C775, C795, E071, E075, E077, E703, DAD patserv 77, OHIP location home with OHIP feecodes B960-4, B966, B986, B987, B988, B990-8)
	  • Decline in general health status (2+ non-elective hospital admissions or unscheduled ED visits in the last year, or malaise, fatigue/debility and/or cachexia diagnoses (ICD-10 R53, G933, R64, ICD-9: 795).
	In addition, persons must have 1 or more High Complex Chronic Conditions, as outlined in *Section 2.3 Definitions for Chronic Conditions in BC Health System Matrix segmentation*.

Notes and Limitations:	• Frail in the community in the BCHSM was implemented in British Columbia based on the provision of professional home care services or publicly funded services to assist with ADL. The HSPN has adopted the PGLO definition of frailty because it has the widest population availability; this definition does not currently include home care data. Not all home care recipients are frail (see: Campitelli MA, Bronskill SE, Hogan DA, *et al*. (2016) *The prevalence and health consequences of frailty in a population-based older home care cohort: a comparison of different measures.* BMC Geriatrics; 16: 133, available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4937594/pdf/12877_2016_Article_309.pdf [accessed July 12, 2021]). Restricting to home care populations only could underestimate the total number of individuals with frailty. Therefore, we used a frailty assessment method for use with physician and hospitalization data in Ontario developed and endorsed by PGLO (see: https://rgps.on.ca/wp-content/uploads/2019/08/PGLO-report-May15r.pdf [accessed Feb 11, 2022]).This definition was applied to the attributable population aged 40 years and older (from 65+). Future consideration for additions of using home care data to identify additional frail individuals is under review. • The PGLO frailty definition includes individuals that were a resident in long-term care (LTC), received palliative care services, had dementia, or had two or more of the seven conditions. However, residents receiving palliative care would be first assigned to PS14 and non-palliative residents in LTC facilities would be first assigned to PS13).

PS10 – High Complex Chronic Conditions	
Definition:	People in this population segment have ever been diagnosed with one or more high chronic conditions such as cystic fibrosis, heart failure, organ transplant, have had a stroke, are on dialysis, or have a specific combination of chronic conditions
Data Sources:	DAD, ODB, OHIP, RPDB, SDS
Codes/Algorithms Used:	High Complex Chronic Conditions are outlined in *Section 2.3 Definitions for Chronic Conditions for the BC Health System Matrix segmentation.*
Notes and Limitations:	The BCHSM includes Alzheimer's disease or other dementia as High Complex Chronic Conditions. However, these individuals also meet the PGLO definition of frailty so would be first assigned to PS11.

PS09 – Frail in the Community	
Definition:	People in this population segment are 40 years of age or older and met the PGLO frailty definition (had two or more of the seven following conditions: cognitive impairment, incontinence, falls, nutritional difficulties, functional difficulties, targeted health service utilization or decline in general health status) and reside in the community.
Data Sources:	CCRS - LTC, DAD, HCD, NACRS, ODB, OHIP, RAICA, RAIHC, RPDB

Codes/Algorithms Used:	Frailty includes all persons:
	• With two or more of the following seven conditions identified in DAD or OHIP:
	  • Cognitive impairment, including dementia and delirium (ICD-10 codes F05X: F050, F051, F058, F059 and ICD-9 codes 293)
	  • Incontinence (ICD-10: R32, R15),
	  • Falls (ICD-10: E9177, E9178, E9293, W01,W05-W19)
	  • Nutritional difficulties (ICD-10: R627, R634, R633, R630, F500, F501, R63, R636, R638,78322, 7833, 7839),
	  • Functional difficulties (ICD-10: R26, R262, M6250-9, M6281, L89X)
	  • Targeted health service utilization (OHIP specialty 07 with OHIP feecodes W770, W775, W795, A770, A775, A795, C770, C775, C795, E071, E075, E077, E703, DAD patserv 77, OHIP location home with OHIP feecodes B960-4, B966, B986, B987, B988, B990-8)
	  • Decline in general health status (2+ non-elective hospital admissions or unscheduled ED visits in the last year, or malaise, fatigue/debility and/or cachexia diagnoses (ICD-10 R53, G933, R64, ICD-9: 795).

Notes and Limitations:	• Frail in the community in the BCHSM is based the provision of professional home care services or publicly funded services to assist with ADL. Not all home care recipients are frail, however (see: Campitelli MA, Bronskill SE, Hogan DA, *et al.* (2016) *The prevalence and health consequences of frailty in a population-based older home care cohort: a comparison of different measures.* BMC Geriatrics; 16: 133, available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4937594/pdf/12877_2016_Article_309.pdf [accessed July 12, 2021]). Further, restricting to home care populations only could underestimate the total number of individuals with frailty. Therefore, we used a frailty assessment method for use with physician and hospitalization data in Ontario developed and endorsed by PGLO (see: https://rgps.on.ca/wp-content/uploads/2019/08/PGLO-report-May15r.pdf [accessed Feb 11, 2022]). This definition was applied to the attributable population aged 40 years and older (from 65+). • The PGLO frailty definition includes individuals that were a resident in long-term care (LTC), received palliative care services, had dementia, or had two or more of the seven conditions. However, residents in LTC facilities would be reassigned

to PS13; residents receiving palliative care would be reassigned to PS14; and residents with dementia would be in the Frail with High Complex Chronic Conditions category (PS11)

PS08 – Maternity and Healthy Newborns

Definition: Women who are pregnant or delivered a baby in the prior year, and their healthy newborns.

Data Sources: DAD, MOMBABY, OHIP, RPDB

Codes Used:

Women who are pregnant were identified by having any of the following codes assigned in the prior year:

Dataset	Codes Used
OHIP	FEECODES A920, A921, P002, P003, P004, P005, Q605, Q606, or Q607 with LOCATION = office, home, LTC, or phone/ virtual

Women who delivered were identified by having any of the following codes assigned in the prior year:

Dataset	Codes Used
MOMBABY	Any record in period

Healthy newborns were identified as being born in the prior year with a typical length of stay in hospital, and without a hospital transfer or special care unit days

Dataset	Codes Used
RPDB	Birth day in the period
MOMBABY linked to DAD	Hospital births with the following code are re-assigned to PS04: SCU1-SCU6 = 50, 51, 52, 53 CMG code not = 576, 577 Discharge disposition not = 04, 05 Length of stay > 2 days

Notes and Limitations:

- Pregnancy code set from Iqbal J et al. (2017) *Association of the timing of pregnancy with survival in women with breast cancer.* JAMA Oncol; 3(5): 659-665 available at: https://jamanetwork.com/journals/jamaoncology/article-abstract/2608281 [accessed Feb 22, 2022]
- Data on in-home births are not available. These are assumed to be healthy newborns.

PS07 – Mental Health and Substance Use	
Definition:	People who experience severe mental disorders (including substance use disorders) in the prior five years.
Data Sources:	DAD, OMHRS
Codes/Algorithms Used:	Individuals with mental health and/or substance abuse were identified as having any hospitalization record in the past 5 years for substance-related and addictive disorders, schizophrenia spectrum and other psychotic disorders, mood and anxiety disorders, trauma/ stressor related disorders, OCD and related disorders, personality disorders, and deliberate self-harm.

Dataset	Codes Used
DAD	DX10CODE1= F06-F99 or DX10CODE2-DX10CODE25 = X60-X84, Y10-Y19, Y28 when DX10CODE1 ne F06-F99
OMHRS	Any OMHRS (including missing, except for 290.x, 294.x in primary diagnosis). If primary dx missing and provisional=2, exclude

Notes and Limitations:	N/A

PS06 – Medium Complex Chronic Conditions	
Definition:	People in this population segment have ever been diagnosed with one or more medium chronic conditions such as angina, COPD, multiple sclerosis, Parkinson's, pre-dialysis chronic kidney disease, rheumatoid arthritis, have had a major cardiac event or intervention, or have a specific combination of chronic conditions.
Data Sources:	DAD, ODB, OHIP, OMHRS, RPDB, SDS
Codes/Algorithms Used:	Medium Complex Chronic Conditions are outlined in *Section 2.3 Definitions for Chronic Conditions in BC Health System Matrix segmentation*.
Notes and Limitations:	N/A

PS05 – Low Complex Chronic Conditions	
Definition:	People in this population segment have ever been diagnosed with one or more low complex chronic conditions, such as asthma, mood, or anxiety disorder including depression, diabetes, epilepsy, hypertension, osteoarthritis, or osteoporosis.
Data Sources:	DAD, ODB, OHIP, OMHRS, RPDB, SDS
Codes/Algorithms Used:	Low Complex Chronic Conditions are outlined in *Section 2.3 Definitions for Chronic Conditions in BC Health System Matrix segmentation*.
Notes and Limitations:	N/A

PS04 – Child and Youth Major <18 years	
Definition:	Residents who are under 18 years old with major health conditions that were not identified in other population segments.
Data Sources:	CCRS (LTC and CCC), DAD, HCD, NACRS, NRS, ODB, OHIP, OMHRS, RPDB, SDS
Codes/Algorithms Used:	Individuals were included in PS04 if they were <18 years of age and in the prior year • Used more than $1,500 in physician services, or • Used more than $1,000 in drugs dispensed, or • Used more than $0 in day surgery costs • Used more than $0 in hospital (inpatient + OMHRS) costs • Newborns that were not healthy (see PS08) are counted towards this segment as well.
Notes and Limitations:	• Drug costs are not available for the majority of residents <18 years of age. Counts may therefore be underreported. • Methods for ascertaining costs for services used can be found in Wodchis WP, et al (2013) *Guidelines on Person-Level Costing Using Administrative Databases in Ontario. Working Paper Series. Vol 1*. Toronto: Health System Performance Research Network. Available at: https://tspace.library.utoronto.ca/bit-stream/1807/87373/1/Wodchis%20et%20al_2013_Guidelines%20on%20Person-Level%20Costing.pdf [accessed Feb 11, 2022]

PS03 – Adult Major Age 18+ years	
Definition:	Residents who are 18 years old or older with major health conditions that are not identified in other population segments.
Data Sources:	CCRS (CCC and LTC), DAD, HCD, NACRS, NRS, ODB, OHIP, OMHRS, RPDB, SDS
Codes/Algorithms Used:	Individuals were included in PS03 if they were 18 years of age or older and in the prior year • Used more than $1,500 in physician services • Used more than $1,000 in drugs dispensed • Used more than $0 in day surgery costs • Used more than $0 in hospital (inpatient + OMHRS) costs
Notes and Limitations:	• Drug costs are not available for the majority of residents <65 years of age. Counts may therefore be underreported. • Methods for ascertaining costs for services used can be found in Wodchis WP, et al (2013) *Guidelines on Person-Level Costing Using Administrative Databases in Ontario. Working Paper Series. Vol 1*. Toronto: Health System Performance Research Network. Available at: https://tspace.library.utoronto.ca/bit-stream/1807/87373/1/Wodchis%20et%20al_2013_Guidelines%20on%20Person-Level%20Costing.pdf [accessed Feb 11, 2022]

PS02 – Healthy	
Definition:	Residents who are low users of publicly funded services, and do not have any of the health conditions that are identified in the other population segments.
Data Sources:	CCRS (CCC and LTC), DAD, HCD, NACRS, NRS, ODB, OHIP, OMHRS, SDS
Codes/Algorithms Used:	Individuals were included in PS02 if in the prior year they • Used less than $1,500 in physician services • Used less than $1,000 in drugs dispensed • Used $0 in day surgery costs • Used $0 in hospital (inpatient + OMHRS) costs
Notes and Limitations:	• Drug costs are not available for the majority of residents <65 years of age. Counts may therefore be overreported. • Methods for ascertaining costs for services used can be found in Wodchis WP, et al (2013) *Guidelines on Person-Level Costing Using Administrative Databases in Ontario. Working Paper Series. Vol 1*. Toronto: Health System Performance Research Network. Available at: https://tspace.library.utoronto.ca/bit-stream/1807/87373/1/Wodchis%20et%20al_2013_Guidelines%20on%20Person-Level%20Costing.pdf [accessed Feb 11, 2022]

PS01 – Non-users	
Definition:	Residents who do not use any of the public health services included in Health System Matrix
Data Sources:	CCRS (CCC and LTC), DAD, HCD, NACRS, NRS, ODB, OHIP, OMHRS, SDS
Codes/Algorithms Used:	Individuals were included in PS01 if they had $0 is health care costs across sectors (excluding capitation costs) in the prior year.
Notes and Limitations:	• Methods for ascertaining costs for services used can be found in Wodchis WP, et al (2013) *Guidelines on Person-Level Costing Using Administrative Databases in Ontario. Working Paper Series. Vol 1*. Toronto: Health System Performance Research Network. Available at: https://tspace.library.utoronto.ca/bit-stream/1807/87373/1/Wodchis%20et%20al_2013_Guidelines%20on%20Person-Level%20Costing.pdf [accessed July 13, 2021]

2.2 – Segment Data Lookback Periods for the BC Health System Matrix segmentation

The figure below highlights the data lookback period applied to each segment. For ascertainment of chronic conditions, all available data are used (i.e., back to 1991 for OHIP billings).

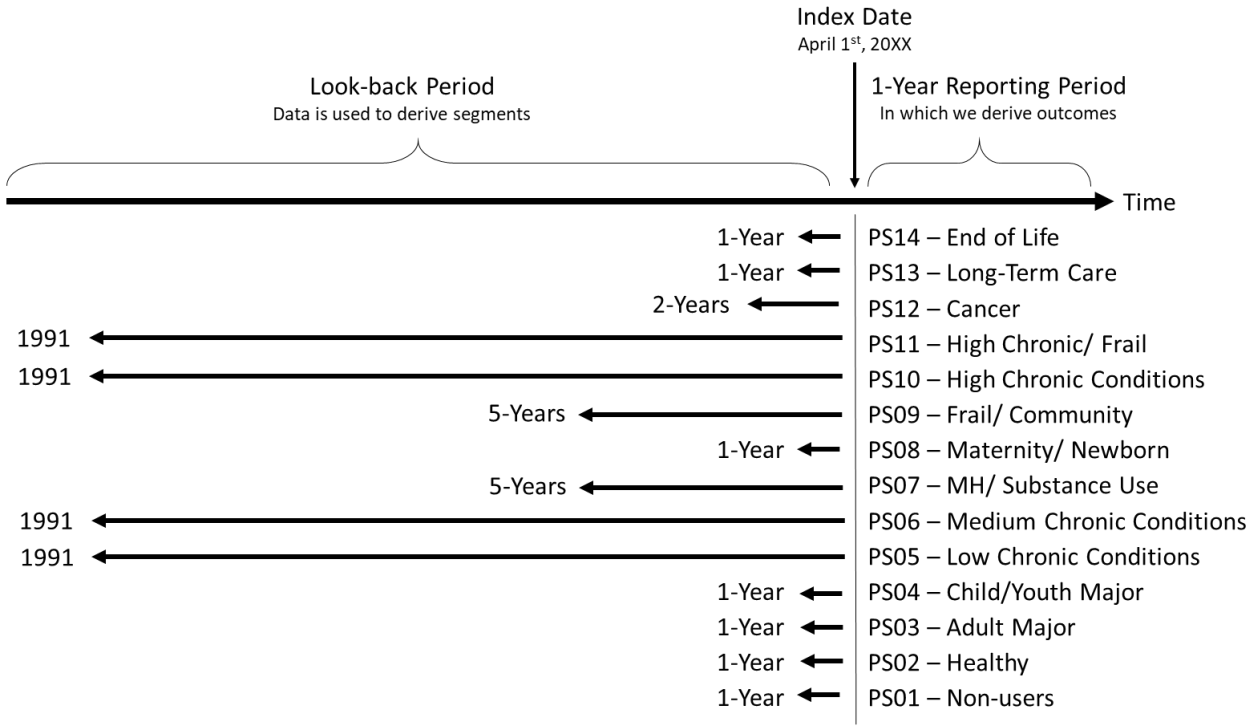

Figure 1. BCHSM Segment Data Lookback Periods

2.3 – Definitions for Chronic Conditions for the BC Health System Matrix segmentation

Table 2 below lists the chronic conditions and combinations of chronic conditions for Low, Medium and High Complex Chronic Condition segments. Technical specifications for each individual condition follow.

Table 2. Types and Combinations of Chronic Conditions for Low, Medium and High Complex Chronic Condition Segments

High CCs	Medium CCs	Low CCs
Alzheimer's and other dementias	Angina	Asthma
Cystic fibrosis (episodic)	COPD	Mood/anxiety disorder (episodic)
Heart failure	Multiple sclerosis	Diabetes
Organ transplant	Parkinson's disease	Epilepsy
Stroke	Chronic kidney disease (pre-dialysis)	Hypertension
Chronic kidney disease (on dialysis)	Rheumatoid arthritis	Osteoarthritis
	Coronary artery bypass graft	Osteoporosis
	AMI	
	Percutaneous transluminal coronary angioplasty	
AMI & Chronic kidney disease (pre-dialysis)	Diabetes & Mood/anxiety disorder (episodic)	
Angina & COPD	Osteoarthritis & Hypertension	
Diabetes & Hypertension & Osteoarthritis	Osteoporosis & Hypertension	
	Osteoporosis & Osteoarthritis	

Alzheimer's and Other Dementias	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	DEMENTIA (ICES derived cohort)
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥1 ODB claim for cholinesterase inhibitors or ≥3 OHIP at least 30 days apart in a two-year period • OHIP (ICD9): 290, 331 • ICD9: 46.1, 290.0, 290.2, 290.3, 290.4, 294.1, 294.2, 331.0, 331.1, 331.5 • ICD10: F00, F01, F02, F03, G30
Age Criteria (years):	≥40
Notes and Limitations:	• See: Jaakkimainen RL et al (2016) *Identification of physician-diagnosed Alzheimer's disease and related dementias in population-based administrative data: a validation study using family physicians' electronic medical records.* Journal of Alzheimer's Disease, 54: 337-349 for details.

Cystic Fibrosis (episodic)	
Reference:	N/A
Data Sources:	DAD, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) • ICD9: 277.0 • ICD10: E84, P75
Age Criteria (years):	≥1
Notes and Limitations:	• Physician data was not included due to specificity of diagnosis codes in the data

Heart Failure	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	CHF (ICES derived cohort)
Codes/ Algorithm Used:	≥1 Hosp (DAD, SDS, OMHRS) or 1 OHIP/ED, followed by ≥1 Hosp/ED/OHIP within one year • OHIP (Feecode): Q050 • ICD9: 428 • ICD10: I500, I501, I509
Age Criteria (years):	≥40
Notes and Limitations:	• See: Schultz SE, *et al.* (2013) *Identifying cases of congestive heart failure from administrative data: a validation study using primary care patient records.* Chronic diseases and injuries in Canada;33:160-6 for details

Solid Organ Transplant	
Reference:	N/A
Data Sources:	DAD, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) • CCP: 143, 4369, 455, 456, 495, 5899, 6249, 5352, 6484, 6481, 6483, 675, 530 • CCI: 1AE85, 1GJ85, 1GR85, 1GT85, 1HY85, 1HZ85, 1NK85, 1NP85, 1OA85, 1OB85, 1OJ85, 1OK85, 1PC85, 1WY19
Age Criteria (years):	1 and up
Notes and Limitations:	N/A

Stroke	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Stroke, Hospitalized. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/stroke-hospitalized.pdf [accessed July7, 2021]
Data Sources:	DAD, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) • ICD9: 362.3, 430, 431, 433X1, 434, 436 • ICD10: H341, I60, I61, I63, I64 • Exclude I63.6 or any traumatic brain injury in record: S02, S06, Z50, 800, 801, 802, 803, 804, 850, 851, 852, 853, 854
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Chronic Kidney Disease on Dialysis	
Reference:	N/A
Data Sources:	DAD, OHIP, SDS
Codes/ Algorithm Used:	Chronic Kidney Disease: ≥1 Hosp (DAD/SDS) or ≥2 OHIP in a two-year period • OHIP (ICD9): 403, 585 • ICD9: 4030, 4031, 4039, 4040, 4049, 585, 586, 5888, 5889, 2504 • ICD10: E102, E112, E132, E142, I12, I13, N08, N18, N19 Dialysis: ≥1 Hosp (DAD/SDS) or ≥1 OHIP • OHIP (Feecode): R849, G323, G325, G326, G860, G862, G863, G865, G866, G082, G083, G085, G090, G091, G092, G093, G094, G095, G096, G294, G295, G330, G331, G332 (from 1992 to 1998 only), G861, G864, G333, H540, H740 • CCP: 5195, 6698 • CCI: 1PZ21HQBS, 1PZ21HQBR, 1PZ21HPD4 Both CKD and Dialysis algorithms must be met
Age Criteria (years):	≥1
Notes and Limitations:	N/A

Angina	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Angina. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/angina.pdf [accessed July7, 2021]
Data Sources:	DAD, OHIP, SDS
Codes/ Algorithm Used:	≥1 Hosp or ≥2 OHIP in a one-year period • ICD9: 413 • ICD10: I20
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Chronic Obstructive Pulmonary Disease (COPD)	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	COPD (ICES derived cohort – specific definition used)
Codes/ Algorithm Used:	≥1 Hosp or ≥3 OHIP in a two-year period • ICD9: 491, 492, 496 • ICD10: J41, J42, J43, J44
Age Criteria (years):	≥35
Notes and Limitations:	• See Gershon A, *et al*. (2009) *Identifying individuals with physician diagnosed COPD in health administrative databases.* COPD. 6:388-94 for details

Multiple Sclerosis	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Multiple Sclerosis. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/multiple-sclerosis.pdf [accessed July7, 2021]
Data Sources:	DAD, SDS, OHIP
Codes/ Algorithm Used:	≥1 Hosp or ≥5 OHIP in a two-year period • OHIP (ICD9): 340 • ICD9: 340 • ICD10: G35
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Parkinson's Disease	
Reference:	Butt DA, Tu K, Young J, *et al.* A validation study of administrative data algorithms to identify patients with Parkinsonism with prevalence and incidence trends. Neuroepidemiology. 2014;43(1):28-37
Data Sources:	OHIP
Codes/ Algorithm Used:	≥3 OHIP (30 days apart) in a two-year period • ICD9: 332
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Pre-Dialysis Chronic Kidney Disease	
Reference:	N/A
Data Sources:	DAD, OHIP, SDS
Codes/ Algorithm Used:	Chronic Kidney Disease: ≥1 Hosp (DAD/SDS) or ≥2 OHIP in a two-year period • OHIP (ICD9): 403, 585 • ICD9: 4030, 4031, 4039, 4040, 4049, 585, 586, 5888, 5889, 2504 • ICD10: E102, E112, E132, E142, I12, I13, N08, N18, N19 Dialysis: ≥1 Hosp (DAD/SDS) or ≥1 OHIP • OHIP (Feecode): R849, G323, G325, G326, G860, G862, G863, G865, G866, G082, G083, G085, G090, G091, G092, G093, G094, G095, G096, G294, G295, G330, G331, G332 (from 1992 to 1998 only), G861, G864, G333, H540, H740 • CCP: 5195, 6698 • CCI: 1PZ21HQBS, 1PZ21HQBR, 1PZ21HPD4 CKD but NOT Dialysis algorithm must be met
Age Criteria (years):	≥1
Notes and Limitations:	N/A

Rheumatoid Arthritis	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	ORAD (ICES derived cohort)
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥3 OHIP (with ≥1 of the claims made by a musculoskeletal specialist (IPDB) –Rheumatology, Orthopedic surgery, or Internal medicine) • ICD9: 714 • ICD10: M05, M06
Age Criteria (years):	≥15
Notes and Limitations:	• See Widdifield J, *et al.* (2014) *An administrative data validation study of the accuracy of algorithms for identifying rheumatoid arthritis: the influence of the reference standard on algorithm performance*. BMC musculoskeletal disorders.15(1):216 and Widdifield J, *et al.* (2013) *Accuracy of Canadian health administrative databases in identifying patients with rheumatoid arthritis: a validation study using the medical records of rheumatologists*. Arthritis care & research. 65(10):1582-91 for full details.

Coronary Artery Bypass Graft (CABG)	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: CABG. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/ischemic-heart-disease.pdf [accessed July7, 2021]
Data Sources:	DAD, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) • CCP: 4811, 4812, 4813, 4814, 4815, 4816, 4817, 4819 • CCI: 1IJ57LA, 1IJ57VS, 1IJ76
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Acute Myocardial Infarction (AMI)	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: AMI, hospitalized. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/acute-myocardial-infraction-hospitalized.pdf [accessed July 7, 2021]
Data Sources:	DAD, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) • ICD9: 410 • ICD10: I21, I22
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Percutaneous Transluminal Coronary Angioplasty	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: PTCA. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/ischemic-heart-disease.pdf [accessed July7, 2021]
Data Sources:	DAD, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) • CCP: 4802, 4803 • CCI: 1IJ50, 1IJ57G
Age Criteria (years):	≥20
Notes and Limitations:	N/A

Asthma	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	ASTHMA (ICES derived cohort – specific definition used)
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥3 OHIP in a two-year period • ICD9: 493 • ICD10: J45, J46
Age Criteria (years):	<99
Notes and Limitations:	• See Gershon AS, *et al.* (2009) *Identifying patients with physician-diagnosed asthma in health administrative databases.* Can Respir J;16:183-8, Gershon AS, *et al.* (2010) *Trends in Asthma Prevalence and Incidence in Ontario, Canada, 1996–2005: A Population Study.* Am J Epidemiol.172 (6): 728-736 and To T, *et al.* (2004) *Defining asthma in children for surveillance*, Am J Respir Crit Care Med, vol. 169 7pg. A383 for full details.

Mood/Anxiety Disorders (episodic)	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Mood/ anxiety disorders, episodic. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/mood-anxiety-disorders-episodic.pdf [accessed July7, 2021]
Data Sources:	DAD, OHIP, OMHRS, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS/OMHRS) or ≥2 OHIP in a two-year period AND ≥1 Hosp (DAD/SDS/OMHRS) or ≥1 OHIP in the prior two years (episodic care) • ICD9: 296, 300, 311 • ICD10: F30, F31, F32, F33, F34, F38, F39, F40, F41, F42, F43, F44, F45, F48, F68
Age Criteria (years):	≥1
Notes and Limitations:	N/A

Diabetes	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	ODD (ICES derived cohort – specific definition used)
Codes/ Algorithm Used:	≥3 OHIP in a one-year period (18+) or ≥4 OHIP two-year period OR ≥1 OHIP procedure (<18) • OHIP (Feecode): Q040, K029, K030, K045, K046 • ICD9: 250
Age Criteria (years):	All ages
Notes and Limitations:	• See Guttmann A, *et al.* (2010) *Validation of a health administrative data algorithm for assessing the epidemiology of diabetes in Canadian children.* Pediatric diabetes. 11(2):122-8. Lipscombe LL, *et al.* (2018) *Identifying diabetes cases from administrative data: a population-based validation study.* BMC Health Services Research 18:316, and Hux JE, *et al.* (2002) *Diabetes in Ontario Determination of prevalence and incidence using a validated administrative data algorithm*. Diabetes care 25:512-6 for full details.

Epilepsy	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Epilepsy. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/epilepsy.pdf [accessed July 7, 2021]
Data Sources:	DAD, OHIP, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥3 OHIP separated by 30 days in a two-year period • OHIP (ICD9): 345 • ICD9: 3450, 3451, 3454, 3455, 3456, 3457, 3458, 3459 • ICD10: G40
Age Criteria (years):	≥1
Notes and Limitations:	N/A

Hypertension	
Reference:	ICES Data Dictionary. Available at: https://datadictionary.ices.on.ca/Applications/DataDictionary/Default.aspx [accessed Feb 11, 2022]
Data Sources:	HYPER (ICES derived cohort)
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥1 OHIP followed by ≥1 OHIP or ≥1 Hosp in a two-year period • ICD9: 401, 402, 403, 404, 405 • ICD10: I10, I11, I12, I13, I15
Age Criteria (years):	≥20
Notes and Limitations:	• See Tu K, *et al.* (2007) Accuracy of administrative databases in identifying patients with hypertension. Open Medicine;1:18-26 and Tu K, *et al.* (2008) Prevalence and incidence of hypertension from 1995 to 2005: a population-based study. Canadian Medical Association Journal. 178(11):1429-35 for full details.

Osteoarthritis	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Osteoarthritis. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/osteoarthritis.pdf [accessed July7, 2021]
Data Sources:	DAD, OHIP, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥2 OHIP in a one-year period • ICD9: 715 • ICD10: M15, M16, M17, M18, M19
Age Criteria (years):	≥1
Notes and Limitations:	N/A

Osteoporosis	
Reference:	BC Chronic Disease and Selected Procedure Case Definitions: Osteoporosis. Available at: http://www.bccdc.ca/resource-gallery/Documents/Chronic-Disease-Dashboard/osteoporosis.pdf [accessed July7, 2021]
Data Sources:	DAD, OHIP, SDS
Codes/ Algorithm Used:	≥1 Hosp (DAD/SDS) or ≥2 OHIP in a one-year period • OHIP (ICD9): 733 • ICD9: 7330 • ICD10: M80, M81, M82
Age Criteria (years):	≥50
Notes and Limitations:	N/A

3.0 – Material Deprivation Quintile

Quintile of material deprivation is derived from the 2016 Ontario Marginalization Index data [10]. Values are assigned to the attributed population based on location of residence as of April 1st of a reporting period (i.e., at baseline). This area-based measure of socioeconomic status is derived from census data on dissemination areas of Ontario, geographic units containing approximately 400 to 700 individuals. The material deprivation measure of the Ontario Marginalization Index includes dimensions of education level attained, household structure, household income (and low-income households), and housing. The measure is closely connected to poverty and reflects the ability of individuals and/or communities to attain basic material needs. All dissemination areas of Ontario are ranked according to their level of material deprivation and then divided into quintiles for segmentation (where quintile 1 reflects low material deprivation or higher affluence and quintile 5 reflects high deprivation or low affluence).

4.0 – Primary Care Patient Enrolment Model

Primary care enrolment models (PEMs) were introduced in Ontario in the early 2000s with the goal of improving patient healthcare experience and providing a better working environment for primary care physicians [11]. Along with changes to how physicians are paid, patients are formally registered with a physician or group. The CAPE database tracks patient enrolment. We assign persons in the attributed population to a unique model of care on April 1st of a reporting period (i.e., at baseline) and segment PEMS according to the model of care including: enhanced fee-for-service models including Family Health Groups (FHG) and Comprehensive Care Models (CCM), capitation (Family Health Networks [FHN] and Family Health Organizations [FHO]), Family Health Groups (FHG), and Other Groups (for example, Rural and Northern [RAN]). Those not formally rostered – roughly 25% of the attributable population – are assigned to a Not Rostered segment.

5.0 – Canadian Institutes for Health Information Population Grouping Methodology

The Canadian Institute for Health Information developed the Population Grouping methodology to predict health care costs and use of selected health system resources using diagnoses obtained from prior patient health care encounters across multiple sectors. With the data collected, full clinical profiles are created for all individuals in the attributable population, and an individual's most complex and clinically relevant health condition is identified. Health Profile Group categories (i.e., segments) include major acute, major chronic, major cancer, major mental health, major newborn, moderate acute, moderate chronic, minor acute, minor chronic, other cancer, other mental health, obstetrics, healthy newborn, palliative, users with no health conditions and non-users of health care. Full details of the methodology are available elsewhere [12].

6.0 – HSPN Total Population Indicators Technical Specifications

Premature mortality	
Rationale:	Premature mortality is a marker of unfulfilled life expectancy, population health, and health system performance
Indicator Reference:	N/A
Data Sources:	OHTAM, RPDB
Numerator (a subset of the denominator):	Number of deaths within the reporting period
Denominator:	Total population less than 75 years of age
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments. Results are expressed as a rate per 100,000 population.
Notes and Limitations:	• Cause of death is not recorded in the RPDB • A lower value is desirable for this measure

Cost per month alive	
Rationale:	Healthcare spending is highly skewed across the population. Understanding average cost differences across attributable population can facilitate allocation of resources including interventions to improve the management of high-cost individuals.
Indicator Reference:	Wodchis WP, Bushmeneva K, Nikitovic M, McKillop I. Guidelines on Person Level Costing Using Administrative Databases in Ontario. Working Paper Series. Vol 1. Toronto: Health System Performance Research Network; 2013
Data Sources:	CAPE, CCRS, DAD, ESTSOB, GAPP, HCD, NACRS, NRS, OCCI, OHCAS, OHTAM, ODB, OHIP, OMHRS, RPDB, SDS
Numerator (a subset of the denominator):	Total attributable government health care spending per individual, divided by the number of months alive in the reporting period
Denominator:	Total population
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments. All costs are in $2020CAD.
Notes and Limitations:	• Costs for care not paid for by the MOH are not included • A lower value is desirable for this measure

Days in acute inpatient care	
Rationale:	An indicator of efficiency, a shorter inpatient stay will reduce costs and shift care to (less costly) post-acute settings
Indicator Reference:	N/A
Data Sources:	DAD, OHTAM, RPDB
Numerator (a subset of the denominator):	Total days spent in acute care in the reporting period
Denominator:	Total population with one or more days spent in non-psychiatric acute care hospital in the reporting period
Exclusions:	Persons without a hospitalization record in the reporting period (approximately 95% of the total population)
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A lower value is desirable for this measure

Alternate level of care (ALC) days*	
Rationale:	Alternate Level of Care (ALC) describes patients waiting for an appropriate level of care to meet their needs. Most often this refers to hospitalized patients who have finished the acute care phase of treatment but remain in an acute hospital bed using costly resources while awaiting to be discharged to a more appropriate setting (for example, home care, inpatient rehabilitation, complex continuing care, assisted living or long-term care facility).
Indicator Reference:	Ontario MOH: http://www.health.gov.on.ca/en/pro/programs/ris/docs/alternate_level_of_care_days_en.pdf [accessed Jan15, 2021] Collaborative Quality Improvement Plan – Technical Specifications 2022/23 (Ontario Health)
Data Sources:	DAD, OHTAM, RPDB
Numerator (a subset of the denominator):	Total number of inpatient days designated as ALC in the reporting period
Denominator:	Total number of inpatient days in the reporting period
Exclusions:	Newborn and stillborn inpatient records
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A lower value (%) is desirable for this measure

* This is also a FY 2022/23 OH collaborative QIP indicator

Hospitalizations for ambulatory care sensitive conditions (ACSCs)	
Rationale:	Ambulatory care sensitive conditions (ACSCs) reflect chronic conditions which, if treated and monitored effectively in the community, should reduce the likelihood for a hospital admission. ACSC hospitalizations may also reflect poor access to primary/specialist care.
Indicator Reference:	Ontario MOH: http://www.health.gov.on.ca/en/pro/programs/ris/docs/hosp_for_ambulatory_care_en.pdf [accessed Jan15, 2021]
Data Sources:	DAD, OHTAM, RPDB
Numerator (a subset of the denominator):	Count of admissions from an acute care hospital in Ontario within the reporting period for any of: grand mal status and other epileptic convulsions (ICD-10 codes that begin with G40 or G41), chronic obstructive pulmonary disease (J41, J42, J43, J44, or J47), asthma (J45), congestive heart failure and pulmonary edema (I50 and J81, excluding cases with cardiac procedures* that are not coded as abandoned after onset); hypertension (I10.0, I10.1, or I11 excluding cases with cardiac procedures* that are not coded as abandoned after onset); angina (I20, I23.82, I24.0, I24.8, or I24.9 excluding cases with cardiac procedures* that are not coded as abandoned after onset), diabetes (E10.0, E10.1, E10.63, E10.9, E11.0, E11.1, E11.63, E11.9, E13.0, E13.1, E13.63, E13.9, E14.0, E14.1,E14.63, E14.9, E10.64, E11.64, E13.64, E14.64), and lower respiratory (J10.0, J11.0, J12-J16, J18, or J20-J22 only when a secondary diagnosis of J44 is also present).
Denominator:	Total population age 74 years and younger.
Exclusions:	Cardiac procedures* resulting in an exclusion include CCI codes beginning with: 1HA58, 1HA80, 1HA87, 1HB53, 1HB54, 1HB55, 1HB87, 1HD53, 1HD54, 1HD55, 1HH59, 1HH71, 1HJ76, 1HJ82, 1HM57, 1HM78, 1HM80, 1HN71, 1HN80, 1HN87, 1HP76, 1HP78, 1HP80, 1HP82, 1HP83, 1HP87, 1HR71, 1HR80, 1HR84, 1HR87, 1HS80, 1HS90, 1HT80, 1HT89, 1HT90, 1HU80, 1HU90, 1HV80, 1HV90, 1HW78, 1HW79, 1HX71, 1HX78, 1HX79, 1HX80, 1HX83, 1HX86, 1HX87, 1HY85, 1HZ53, 1HZ54, 1HZ55, 1HZ56, 1HZ57, 1HZ59, 1HZ80, 1HZ85, 1HZ87, 1IF83, 1IJ50, 1IJ55, 1IJ57, 1IJ76, 1IJ80, 1IK57, 1IK80, 1IK87, 1IN84, 1LA84, 1LC84, 1LD84, 1IJ86 and not equal to 1HZ53LAKP or 1HZ55LAKP. Records indicating an admission for newborn or stillborn were also excluded.
Standardization:	Observed or unadjusted data are presented across segments. Results are expressed as a rate per 100,000 population.
Notes and Limitations:	• A lower value is desirable for this measure

Readmissions within 30 days for selected HBAM Inpatient Grouper (HIG) conditions	
Rationale:	Measuring hospital readmissions may provide insight to the quality of care of inpatient and post-discharge services provided to patients.
Indicator Reference:	Ontario MOH: http://www.health.gov.on.ca/en/pro/programs/ris/docs/readmission_30days_selected_higs_en.pdf [accessed Jan15, 2021]
Data Sources:	DAD, OHTAM, RPDB
Numerator (a subset of the denominator):	Hospital readmissions with the admission date within 30 days of the index (denominator) discharge, where the admission category is coded as urgent/ emergent and the admission is not coded as an acute transfer.
Denominator:	Patients discharged from an acute care hospital in Ontario within the reporting period with any of: Acute Myocardial Infarction (age 45+, HIG: 193a, 193b, 194a, 194b), cardiac conditions other than heart attack (age 40+, HIG: 202, 204a, 204b, 208a, 208b), congestive heart failure (age 45+, HIG: 196), chronic obstructive pulmonary disease (age 45+, HIG: 139c, 139d), pneumonia (all ages, HIG: 136, 138, 143), diabetes (all ages, HIG: 437a, 437b, 437c, 437d), stroke (age 45+, HIG: 025, 026, 028), or gastrointestinal disease (all ages, HIG: 231, 248, 251, 253, 254, 255, 256, 257, 258, 285, 286, 287, 288)
Exclusions:	Hospital records where the Inpatient HIG atypical code was not in: '00' (typical cases), '01' (transfer in cases), '09' (short stay outlier cases), '10' (long stay outlier cases), or '11' (transfer in long stay cases). Records coded as transfers to another acute inpatient hospital, deaths, or sign outs were also not considered.
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A lower value (%) is desirable for this measure

Emergency visits for conditions that could be treated in alternative primary care setting	
Rationale:	Higher rates of emergency visits for conditions that could be treated in alternative settings may reflect poor access to primary care services.
Indicator Reference:	Ontario MOH: http://www.health.gov.on.ca/en/pro/programs/ris/docs/hosp_for_ambulatory_care_en.pdf [accessed Jan15, 2021]
Data Sources:	NACRS, OHTAM, RPDB
Numerator (a subset of the denominator):	Count of unscheduled visits to emergency departments where the main problem (ICD-10) was any of: A740, B309, H100, H101, H102, H103, H104, H105, H108, H109, H130, H131, H132, H133, N300, N301, N302, N303, N304, N308, N309, N330, N390, H650, H651, H652, H653, H654, H659, H660, H661, H662, H663, H664, H669, H670, H671, H678, J00, J010, J011, J012, J013, J014, J018, J019, J028, J029, J038, J039, J040, J041, J060, J068, J069, J310, J311, J312, J320, J321, J322, J323, J324, J328, J329, J350, J351, J352, J353, J358, J359, or J399, and the visit was assigned low acuity (CTAS level IV [less-urgent] or V [non-urgent])
Denominator:	Total population age 1 to 74 years
Exclusions:	Emergency visits where the patient was admitted to hospital, or not seen by a physician.
Standardization:	Observed or unadjusted data are presented across segments. Results are expressed as a rate per 1,000 population
Notes and Limitations:	• A lower value is desirable for this measure

Physician visits after discharge from hospital for selected HBAM Inpatient Grouper (HIG) conditions	
Rationale:	This indicator measures the transition of continuity of patient care from the acute to community settings. The days immediately following discharge can be high risk and a vulnerable transition period for many patients.
Indicator Reference:	Ontario MOH: http://www.health.gov.on.ca/en/pro/programs/ris/docs/physician_visits_after_disch_hosp_en.pdf [accessed Jan15, 2021]
Data Sources:	DAD , OHIP, OHTAM, RPDB
Numerator (a subset of the denominator):	Physician consults/ visits occurring within 0 to 7 days from discharge taking place in an office, home or long-term care setting.
Denominator:	Patients discharged from an acute care hospital in Ontario within the reporting period with any of: Acute Myocardial Infarction (age 45+, HIG: 193a, 193b, 194a, 194b), cardiac conditions other than heart attack (age 40+, HIG: 202, 204a, 204b, 208a, 208b), congestive heart failure (age 45+, HIG: 196), chronic obstructive pulmonary disease (age 45+, HIG: 139c, 139d), pneumonia (all ages, HIG: 136, 138, 143), diabetes (all ages, HIG: 437a, 437b, 437c, 437d), stroke (age 45+, HIG: 025, 026, 028), or gastrointestinal disease (all ages, HIG: 231, 248, 251, 253, 254, 255, 256, 257, 258, 285, 286, 287, 288)
Exclusions:	Hospital records where the Inpatient HIG atypical code was not in: '00' (typical cases), '01' (transfer in cases), '09' (short stay outlier cases), '10' (long stay outlier cases), or '11' (transfer in long stay cases). Records coded as transfers to another acute inpatient hospital, deaths, or sign outs were also not considered.
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A higher value (%) is desirable for this measure

Continuity of Care – Usual Provider of Care (UPC) Index	
Rationale:	Continuity of care is a cornerstone of primary care and is associated with favourable outcomes including lower rates of hospitalization, improved adherence to treatment and greater patient satisfaction.
Indicator Reference:	N/A
Data Sources:	OHIP, OHTAM¸ RPDB
Numerator (a subset of the denominator):	Total number of physician consults/ visits to an individual's most regularly seen doctor
Denominator:	Total number of physician consults/ visits (across all physician specialties) across the most recent 2 years of data
Exclusions:	All persons with fewer than two physician consults/ visits from 2 years prior to the end of the reporting period to the end of the reporting period. Repeat consults/ visits to the same physician on the same day by the same person were excluded from estimation.
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• The UPC is interpreted as the average proportion of an attributed person's contacts that was with their most regularly seen doctor. For example, if an individual had 10 physician visits, 8 of which were with the same physician, then their UPC would be 0.8 • A minimum number of 2 or more visits and 2-year observation period is used in the denominator to increase the stability in estimates • A higher value is desirable for this measure, indicating greater (relational) continuity

Proportion of OHT attributed patients with a virtual physician encounter	
Rationale:	Virtual encounters can improve patient access to services and supports continuity of care. Since COVID-19, demand for virtual encounters has increased.
Indicator Reference:	N/A
Data Sources:	OHIP, OHTAM, RPDB
Numerator (a subset of the denominator):	All persons with one or more physician consults/ visits in the reporting period with a corresponding phone/ virtual code: location=P, or codes B103A, B203A, B209, K080-K083, or pre-April 2020: B100A, B101A, B102A, B200A, B201A, B202A, B099A
Denominator:	All persons with one or more physician consults/ visits in the reporting period
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A higher value (%) is desirable for this measure

6.1 – HSPN Mental Health and Addictions Indicator Technical Specifications

Repeat emergency visits for mental health (within 30 days)	
Rationale:	Repeat unscheduled emergency department visits for mental health and addictions may indicate inadequate transitions from hospital to community care
Indicator Reference:	Ontario MOH http://www.health.gov.on.ca/en/pro/programs/ris/docs/repeat_er_visits_mental_health_en.pdf [accessed Mar26,2021]
Data Sources:	NACRS, OHTAM, RPDP
Numerator (a subset of the denominator):	Presence of 1 or more unscheduled ED visits for mental health conditions or substance abuse within 30 days of the index visit (see denominator)
Denominator:	All unscheduled ED visits for mental health conditions (Primary diagnosis field = F06–F99 or secondary diagnosis fields = X60–X84, Y10–Y19, Y28 when primary diagnosis is not F06–F99, and excluding substance abuse, ICD-10 F10-F19) in the reporting period
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A lower value is desirable for this measure

7-day follow-up with a physician after hospitalization for MHA	
Rationale:	Timely follow-up with a physician after hospital discharge may help to improve adherence to treatment and reduce the likelihood of readmissions
Indicator Reference:	Mental Health and Addictions System Performance in Ontario, 2021 Scorecard: http://www.health.gov.on.ca/en/pro/programs/ris/docs/alternate_level_of_care_days_en.pdf [accessed Mar26, 2021]
Data Sources:	DAD, OHIP, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	Consults/ visits with primary care providers, psychiatrists and/or pediatricians occurring within 7 days from discharge taking place in an office, home or long-term care setting.
Denominator:	Patients discharged alive from a hospital in Ontario for mental health and addictions in the reporting period (Primary diagnosis field = F06–F99 or secondary diagnosis fields = X60–X84, Y10–Y19, Y28 when primary diagnosis is not F06–F99, and excluding substance abuse, ICD-10 F10-F19)
Exclusions:	Patients readmitted to hospital or that died within 30 days of discharge
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A higher value is desirable for this measure

First contact in the emergency department for MHA*	
Rationale:	When community-based mental health and addictions services are unavailable, individuals who require service may use the emergency department as their first point of contact.
Indicator Reference:	Mental Health and Addictions System Performance in Ontario, 2021 Scorecard: http://www.health.gov.on.ca/en/pro/programs/ris/docs/alternate_level_of_care_days_en.pdf [accessed Mar26, 2021] And Collaborative Quality Improvement Plan – Technical Specifications 2022/23 (Ontario Health)
Data Sources:	CHC, DAD, NACRS, OHIP, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	Population without a mental health and addictions-related service contact (hospitalization, ED visit or physician visit) in the 2 years prior to the incident ED visit (see denominator)
Denominator:	Population with an incident (first in the reporting period) unscheduled ED visit for mental health and addictions (Primary diagnosis field = F06–F99 or secondary diagnosis fields = X60–X84, Y10–Y19, Y28 when primary diagnosis is not F06–F99, and excluding substance abuse, ICD-10 F10-F19)
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A lower value is desirable for this measure

* This is also a FY 2022/23 OH collaborative QIP indicator

Frequent (4+) emergency department visits for help with MHA	
Rationale:	Frequent ED visits may be an indication that people do not have access to the community-based services or support they need
Indicator Reference:	Canadian Institute for Health Information indicator library: https://indicatorlibrary.cihi.ca/pages/viewpage.action?pageId=15565180 [accessed Mar26, 2021]
Data Sources:	NACRS, OHTAM, RPDB
Numerator (a subset of the denominator):	Total population with 4 or more ED visits for mental health and addictions in 1 year prior to index visit (see denominator)
Denominator:	Total population with at least 1 ED visit for mental health and addictions (Primary diagnosis field = F06–F99 or secondary diagnosis fields = X60–X84, Y10–Y19, Y28 when DX10CODE1 is not F06–F99) in the reporting period. The most recent encounter is considered the index visit.
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A lower value is desirable for this measure

Rate of emergency department visits for deliberate self-harm	
Rationale:	Deliberate self-harm includes nonfatal self-poisoning or self-injury
Indicator Reference:	Mental Health and Addictions System Performance in Ontario, 2021 Scorecard: http://www.health.gov.on.ca/en/pro/programs/ris/docs/alternate_level_of_care_days_en.pdf [accessed Mar26, 2021]
Data Sources:	NACRS, OHTAM, RPDB
Numerator (a subset of the denominator):	Total number of ED visits for deliberate self-harm (Secondary diagnosis fields = X60–X84, Y10–Y19, Y28 when primary diagnosis is not F06–F99)
Denominator:	Total population aged 10 years and older
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments. Results are presented as a rate per 10,000 population
Notes and Limitations:	• A lower value is desirable for this measure

6.2 – HSPN Older/ Frail Population Indicator Technical Specifications

Days spent at home, among those identified as frail	
Rationale:	Days spent at home is a patient-driven quality indicator. Although some hospital visits are necessary, most people would prefer to spend their time at home.
Indicator Reference:	N/A
Data Sources:	CCRS (CCC and LTC), DAD, NACRS, NRS, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	For each decedent, calculated as the total days in the observation period (or to death) minus the sum of days spent in hospital (DAD and OMHRS data), emergency department (NACRS), inpatient rehab (NRS), and complex continuing care (CCC)

Denominator:	Person-years contributed from the OHT attributed population age 66 years or older that were frail:
	• With a history of dementia (see Jaakkimainen RL et al. (2016) *Identification of physician-diagnosed Alzheimer's disease and related dementias in population-based administrative data: a validation study using family physicians' electronic medical records*. Journal of Alzheimer's Disease, 54: 337-349 for codes), or
	• Residents in a long-term care facility (based on having any record in CCRS in the last 5 years), or
	• Receiving palliative care services (in the past 1 year) based on:
	  • DAD: ICD-10 codes that begin with Z515, patserv=58, prvserv or inserv=00121
	  • OHIP: feecodes that begin with A945, K023, G512, G511, B998,B997, K700, B966, B997, B998, G511, C945, C945, C882, C982, E083 (following C982, C882, C122, C123, C124, C142, C143), B966 (billed with B998/B996), K023, B400, C945, C982, G512, Q641,)
	  • NACRS: prvserv or consultserv = 00121
	  • HCD: src_admission, service_rpc or src_discharge=95, residence_type=2000
	  • RAICA: b2c=1 or b4=12, or
	• With two or more of the following seven conditions identified in DAD or OHIP:
	  • Cognitive impairment, including dementia and delirium (ICD-10 codes F05X: F050, F051, F058, F059 and ICD-9 codes 293)
	  • Incontinence (ICD-10: R32, R15),
	  • Falls (ICD-10: E9177, E9178, E9293, W01,W05-W19)
	  • Nutritional difficulties (ICD-10: R627, R634, R633, R630, F500, F501, R63, R636, R638,78322, 7833, 7839),
	  • Functional difficulties (ICD-10: R26, R262, M6250-9, M6281, L89X)
	  • Targeted health service utilization (OHIP specialty 07 with OHIP feecodes W770, W775, W795, A770, A775, A795, C770, C775, C795, E071, E075, E077, E703, DAD patserv 77, OHIP location home with OHIP feecodes B960-4, B966, B986, B987, B988, B990-8)
	  • Decline in general health status (2+ non-elective hospital admissions or unscheduled ED visits in the last year, or malaise, fatigue/debility and/or cachexia diagnoses (ICD-10 R53, G933, R64, ICD-9: 795).

Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• Observation periods are scaled to 365.25 days to account for leap years • A higher value (mean days) is desirable for this measure

Repeat fall-related emergency visits, among those identified as frail	
Rationale:	Injuries from falls can negatively impact the health and independence of older adults and require costly medical intervention.
Indicator Reference:	N/A
Data Sources:	NACRS, OHTAM, RPDB
Numerator (a subset of the denominator):	Population with a fall-related emergency department visit in the observation period (index event, ICD10: W01, W02, W03, W04, W05, W06, W07, W08, W09, W10, W11, W12, W13, W14, W15, W16, W17, W18, W19) and a second fall-related ED visit within 365 days prior to the index event. Where multiple ED visits occur in the observation period, the most recent ED visit is used as the index event.

Denominator:	The number of OHT attributed population age 66 years or older that were frail
	All persons:
	• With a history of dementia (see Jaakkimainen RL, *et al*. (2016) *Identification of physician-diagnosed Alzheimer's disease and related dementias in population-based administrative data: a validation study using family physicians' electronic medical records*. Journal of Alzheimer's Disease, 54: 337-349 for codes), or
	• Residents in a long-term care facility (based on having any record in CCRS in the last 5 years), or
	• Receiving palliative care services (in the past 1 year) based on:
	  • DAD: ICD-10 codes that begin with Z515, patserv=58, prvserv or inserv=00121
	  • OHIP: feecodes that begin with A945, K023, G512, G511, B998,B997, K700, B966, B997, B998, G511, C945, C945, C882, C982, E083 (following C982, C882, C122, C123, C124, C142, C143), B966 (billed with B998/B996), K023, B400, C945, C982, G512, Q641,)
	  • NACRS: prvserv or consultserv = 00121
	  • HCD: src_admission, service_rpc or src_discharge=95, residence_type=2000
	  • RAICA: b2c=1 or b4=12, or
	• With two or more of the following seven conditions identified in DAD or OHIP:
	  • Cognitive impairment, including dementia and delirium (ICD-10 codes F05X: F050, F051, F058, F059 and ICD-9 codes 293)
	  • Incontinence (ICD-10: R32, R15),
	  • Falls (ICD-10: E9177, E9178, E9293, W01,W05-W19)
	  • Nutritional difficulties (ICD-10: R627, R634, R633, R630, F500, F501, R63, R636, R638,78322, 7833, 7839),
	  • Functional difficulties (ICD-10: R26, R262, M6250-9, M6281, L89X)
	  • Targeted health service utilization (OHIP specialty 07 with OHIP feecodes W770, W775, W795, A770, A775, A795, C770, C775, C795, E071, E075, E077, E703, DAD patserv 77, OHIP location home with OHIP feecodes B960-4, B966, B986, B987, B988, B990-8)
	  • Decline in general health status (2+ non-elective hospital admissions or unscheduled ED visits in the last year, or malaise, fatigue/debility and/or cachexia diagnoses (ICD-10 R53, G933, R64, ICD-9: 795).

Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A lower value is desirable for this measure

Caregiver distress	
Rationale:	Caregiver distress may indicate whether home care clients and their caregivers have access to sufficient and appropriate level of services and supports. It may also help flag where additional resources are needed in order to prevent caregiver burnout.
Indicator Reference:	N/A
Data Sources:	interRAIHC, OHTAM, RPDB
Numerator (a subset of the denominator):	Assessments that indicate a caregiver is unable to continue in caring activities (variable P2A) or the caregiver expresses feelings of distress, anger or depression (P2B)
Denominator:	Total population age 66 years or older with an interRAIHC assessment in the observation period that had a caregiver (variable P1b1 = 0, 1 or 2). For long-stay home care clients with >1 assessment, we take the most recent.
Exclusions:	Assessments that are not the most recent in the reporting period, for those with multiple assessments.
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A lower value (%) is desirable for this measure

Change in Minimum dataset health status index (MDSHSI)	
Rationale:	The MDSHSI is a preference-based health-related quality of life measure derived by mapping items collected in the RAI instrument onto the Health Utilities Index Mark 2 system. It is a single summary score of overall health. The change in MDSHSI captures the individual within-person change in overall health status. Slowing health declines amongst older adults may result from multi-faceted interventions.
Indicator Reference:	N/A
Data Sources:	interRAIHC, OHTAM, RPDB
Numerator (a subset of the denominator):	Change in MDSHSI score from first to most interRAIHC assessment
Denominator:	Total population age 66 years or older with an interRAIHC assessment in the observation period (index assessment) and a second interRAIHC assessment within 365d prior. The index assessment is the most recent in the observation period.
Exclusions:	Clients with <2 interRAIHC assessments within 365d
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• For calculation of the MDSHSI from RAI data, see: Wodchis WP, Hirdes JP and Feeny DH. Health-related quality of life measure based on the minimum data set. Int J Technol Assess Health Care. 2003; 19(3): 490-506 • MDSHSI ranges from -0.03 to 1, with higher scores (approaching 1) indicative of good health. • A value of ≥0.03 is a clinically meaningful difference in MDSHSI • The MDSHSI was validated on the RAIHC assessment instrument, which is not longer used in Ontario. Data items collected on the interRAIHC assessment instrument (which was adopted in Ontario in March 2018) differs, notably for assessing mobility, which results in a marginally higher MDSHSI score. Interpretation requires caution. • A higher value (mean score) is desirable for this measure

Change in Activities of daily living – long form	
Rationale:	This scale provides a measure of a client's ability to perform activities of daily living (ADL), including personal hygiene, dressing, locomotion, toilet use, bed mobility and eating. ADL is the most common measure of function in older adults.
Indicator Reference:	N/A
Data Sources:	interRAIHC, OHTAM, RPDB
Numerator (a subset of the denominator):	Change in ADL Long score from first to most interRAIHC assessment
Denominator:	Total population age 66 years or older with an interRAIHC assessment in the observation period (index assessment) and a second interRAIHC assessment within 365d prior. The index assessment is the most recent in the observation period.
Exclusions:	Clients with <2 interRAIHC assessments within 365d
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• ADL Long ranges from 0 to 28, with higher values indicating greater difficulty in performing activities • A lower value (mean score) is desirable for this measure

6.3 – HSPN End of Life Population Indicator Technical Specifications

Deaths in hospital	
Rationale:	The majority of people would prefer to die at home, rather than in hospital.
Indicator Reference:	Ontario Palliative Care Network. The Ontario Palliative Care Network performance summary report: Technical appendix. May 2020.
Data Sources:	CCRS (CCC and LTC), DAD, NACRS, NRS, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	The number of decedents with a death recorded in DAD (discharge_disposition = 07, 66, 67, 72 ,73, 74), NACRS (visit_disposition = 10, 11, 72, 73, 74, 71), OMHRS (discharge_reason = 2 or 3), NRS (discharge_reason_code = 8) or CCC (discharge_to_facility_type = 11) datasets
Denominator:	The number of OHT attributed patients that died in the reporting period
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• Data on each decedent's preferred place of death is not available • Cause of death is not available in the data sources used for this indicator • Location of death does not necessarily correlate with the location of where care was received before death • A lower value (%) is desirable for this measure

Days spent at home in the last 6 months (180 days) of life	
Rationale:	Days spent at home is a patient-driven quality indicator. Although some hospital visits are necessary, most people would prefer to spend their time at home.
Indicator Reference:	Ontario Palliative Care Network. The Ontario Palliative Care Network performance summary report: Technical appendix. May 2020.
Data Sources:	CCRS (CCC and LTC), DAD, NACRS, NRS, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	For each decedent, calculated as 180 minus the sum of days spent in hospital (DAD and OMHRS data), emergency department (NACRS), inpatient rehab (NRS), and complex continuing care (CCC)
Denominator:	The number of OHT attributed patients that died in the reporting period
Exclusions:	N/A
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A higher value (mean days) is desirable for this measure

Proportion of decedents with one or more emergency department visits in the last 30 days of life	
Rationale:	Unplanned emergency department visits can be a difficult experience for individuals at the end-of-life and may indicate that they did not receive the care they needed in the community.
Indicator Reference:	Ontario Palliative Care Network. The Ontario Palliative Care Network performance summary report: Technical appendix. May 2020.
Data Sources:	CCRS (CCC and LTC), DAD, NACRS, NRS, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	The number of decedents who had one or more unplanned emergency department visits in their last 30 days of life
Denominator:	The number of OHT attributed patients that died in the reporting period
Exclusions:	Decedents that were hospitalized in an acute care facility for the last 30 days of life
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A lower value (%) is desirable for this measure

Proportion of decedents receiving palliative home care in the last 90 days of life	
Rationale:	Increasing in-home palliative care at the end-of-life may improve community home death percentages
Indicator Reference:	Ontario Palliative Care Network. The Ontario Palliative Care Network performance summary report: Technical appendix. May 2020.
Data Sources:	CCRS (CCC and LTC), DAD, HCD, NACRS, NRS, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	All decedents who had at least one palliative home care service (HCD: service_rpc, src_admission or src_discharge=95 and home care service [excluding case management and placement services] in the reporting period) in their last 90 days of life
Denominator:	The number of OHT attributed patients that died in the reporting period
Exclusions:	Decedents that were hospitalized in an acute care facility or long-term care for the last 90 days of life
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A higher value (%) is desirable for this measure

Proportion of decedents receiving palliative physician home visits in the last 90 days of life	
Rationale:	Increasing in-home palliative care at the end-of-life may improve community home death percentages
Indicator Reference:	Ontario Palliative Care Network. The Ontario Palliative Care Network performance summary report: Technical appendix. May 2020.
Data Sources:	CCRS (CCC and LTC), DAD, NACRS, NRS, OHIP, OHTAM, OMHRS, RPDB
Numerator (a subset of the denominator):	All decedents with one or more physician consults/ visits in the reporting period with a corresponding palliative in-home visit code (G511, B966 [billed with B998.B996], B998, B997, A901, B990, B992, B993, B994, B996, A900, B960, B961, B962, B963, B964, B986, B987, B988) in their last 90 days of life
Denominator:	The number of OHT attributed patients that died in the reporting period
Exclusions:	Decedents that were hospitalized in an acute care facility or long-term care for the last 90 days of life
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A higher value (%) is desirable for this measure

6.4 – Collaborative Quality Improvement Indicator Technical Specifications

For ALC and ED First Mental Health and Addiction indicators, please see definitions above.

Percentage of screening eligible patients up-to-date with Papanicolaou (Pap) Tests	
Rationale:	Effective screening enables early detection and may reduce mortality
Indicator Reference:	Collaborative Quality Improvement Plan – Technical Specifications 2022/23 (Ontario Health)
Data Sources:	DAD, OCR, OHIP, RPDB, SDS
Numerator (a subset of the denominator):	Number of screen eligible women aged 23 to 69 years who had a Pap smear in the 3 years prior to the end of the reporting period • Pap tests identified using fee codes in OHIP (E430, G365a, G394a, L712, or L812, Q678, L713 and L733) • Each woman is counted once regardless of the number of Pap tests performed in a three-year period
Denominator:	Total number of screen-eligible women aged 23 to 69 years at index date
Exclusions:	• Women with a history of cervical cancer and/or a hysterectomy • Palliative care patients identified from hospital and physician billing claims data (OHIP feecodes: A945, C945, C882, C982, W872, W882, W972, W982, B998, B966, B997, G511, G512; CIHI DAD patserv: 58; CIHI DAD ICD10 code: Z515)
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A higher value (%) is desirable for this measure

Percentage of screen-eligible patients up-to-date with a mammogram	
Rationale:	Effective screening enables early detection and may reduce mortality
Indicator Reference:	Collaborative Quality Improvement Plan – Technical Specifications 2022/23 (Ontario Health)
Data Sources:	DAD, OBSP, OCR, OHIP, RPDB, SDS
Numerator (a subset of the denominator):	Total number of screen-eligible women aged 52 to 69 years, who have completed at least one mammogram in the 2 years prior to the end of the reporting period. Includes: • OBSP mammograms and Non-OBSP mammograms identified using OHIP feecodes (X172 Unilateral screening mammography; X 178 bilateral screening mammography; X185 diagnostic bilateral mammography)
Denominator:	Total number of screen-eligible women, aged 52 to 69 years at index date
Exclusions:	• Women with a history of breast cancer using the diagnostic code (dxcode-174) • Women with a mastectomy before the two-year period • Palliative care patients identified from hospital and physician billing claims data (OHIP feecodes: A945, C945, C882, C982, W872, W882, W972, W982, B998, B966, B997, G511, G512; CIHI DAD patserv: 58; CIHI DAD ICD10 code: Z515)
Standardization:	Observed or unadjusted data are presented across segments.
Notes and Limitations:	• A higher value (%) is desirable for this measure

Percentage of screen-eligible patients up-to-date with colorectal screening	
Rationale:	Effective screening enables early detection and may reduce mortality
Indicator Reference:	Collaborative Quality Improvement Plan – Technical Specifications 2022/23 (Ontario Health)
Data Sources:	DAD, OCR, OHIP, RPDB, SDS
Numerator (a subset of the denominator):	Number of screen eligible patients aged 52 to 74 years who had a FOBT/FIT 2 years prior to the end of the reporting period, other investigations (i.e., flexible sigmoidoscopy) or colonoscopy 10 years prior to the end of the reporting period. Included: • A fecal occult blood testing (FOBT) or FIT (L181 or G004, L179, Q152, Q043, Q133) • A colonoscopy, codes Z491 through Z499, or Z555 • A flexible sigmoidoscopy, code Z580
Denominator:	Number of screen-eligible patients aged 52 to 74 years at index date
Exclusions:	• Patients who have ever had colon cancer, inflammatory bowel disease or colectomy • Palliative care patients identified from hospital and physician billing claims data (OHIP feecodes: A945, C945, C882, C982, W872, W882, W972, W982, B998, B966, B997, G511, G512; CIHI DAD patserv: 58; CIHI DAD ICD10 code: Z515)
Standardization:	Observed or unadjusted data are presented across segments
Notes and Limitations:	• A higher value (%) is desirable for this measure

References

1. Wodchis WP, Mondor L, & Hall RE. (2021). Frail/Older Adult OHT Priority Population Indicator Results at Baseline: Fiscal Year 2018 to 2020. Toronto, ON: Health System Performance Network.
2. Hall RE, Mondor L & Wodchis WP. (2021). Mental Health and Addiction OHT Priority Population Indicator Results at Baseline: Fiscal Year 2018 to 2020. Toronto, ON: Health System Performance Network.
3. Mondor L, Hall RE, & Wodchis WP. (2021). End-of-Life/Palliative OHT Priority Population Indicator Results at Baseline: Fiscal Year 2018 to 2020. Toronto, ON: Health System Performance Network.
4. Mondor L, Hall RE, & Wodchis WP. (2021). Total OHT Attributable Population Improvement Indicators at Baseline: Fiscal Year 2018 to 2020. Toronto, ON: Health System Performance Network.
5. Wodchis, WP and RJ Reid (2020). "Improving Value Means Increasing Population Health and Equity." Healthc Pap 19(2): 10-15.
6. Cronin S, Tessier L, James KA, Wodchis WP. (2021). Approaches to Population Health Management: Informing Ontario's Health System Transformation. Toronto, ON: Health System Performance Network. 2021.
7. Kadu M, Ma X, Pagalan L, Rosella LC, Wodchis WP. (2021). A Review of Population Segmentation Tools for Population Health Management: Applicability for Ontario Health Teams. Toronto, ON: Health System Performance Network. 2021.
8. Weir DL, Wodchis WP. (2021). Real World Applications of Population Segmentation in Population Health Management. Toronto, ON: Health System Performance Network. 2021.
9. Lynn J, Straube BM, Bell KM, Jencks SF and Kambic RT (2007). Using Population Segmentation to provide Better Health Care for All: The "Bridges to Health" Model. Millbank Quarterly, 85(2): 185-208.
10. Matheson FI, Moloney G, van Ingen T; Ontario Agency for Health Protection and Promotion (Public Health Ontario). (2022). 2016 Ontario Marginalization Index: User Guide. 1st revision. Toronto, ON: St. Michael's Hospital (Unity Health Toronto). Joint publication with Public Health Ontario.
11. Glazier RH, Zagorski BM, Rayner J. (2012). Comparison of Primary Care Models in Ontario by Demographics, Case Mix and Emergency Department Use, 2008/09 to 2009/10. Available at: https://www.ices.on.ca/Publications/Atlases-and-Reports/2012/Comparison-of-Primary-Care-Models
12. Canadian Institute for Health Information. (2017). Methodology Report: CIHI's Population Grouping Methodology 1.1 (compiled code). Ottawa, ON: Canadian Institute for Health Information.