



A Population-Based Study of Older Adults in Ontario: Dementia, Frailty and Utilization of Physician Specialist Services

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1. Introduction

The population of Ontario is aging, and an understanding of the population characteristics of older adults is required to facilitate planning of health services to ensure that all older Ontarians can have optimal access to services. A range of specialized geriatric services (SGS) and community support services are available in Ontario to meet the needs of older adults. The Provincial Geriatrics Leadership Office (PGLO) has recently completed an asset mapping exercise to identify the regional availability of different supports and services across Ontario both provincially and by the Local Health Integration Network. A separate report coordinated by the PGLO has identified physician human health resources involved in the care of older adults in Ontario including geriatric medicine, family physicians with care of the elderly (COE) designation, and geriatric psychiatrists.

The current report provides information on the number of older adults in Ontario, and by local health integration network (LHIN) to identify potential needs related to health services for these populations in Ontario. It is estimated that approximately 225,000 individuals in Ontario are current diagnosed with dementia¹ and that up to 450,000 individuals in Ontario are living with significant degrees of frailty^{2,3}. The focus of this report is to describe the current state of three populations in Ontario that are most often the focus of SGS: older adults (defined as age 66 years and older in this report); older adults living with diagnosed dementia; and older adults with frailty. Administrative healthcare databases available at ICES-Queen's University were used to identify these populations of interest and characterize these populations in order

to provide estimates of the number of individuals in Ontario who may be in need of SGS services and how variation in population demands align with current SGS resources.

In Ontario, the physician specialities of geriatric medicine and geriatric psychiatry are most frequently involved in the assessment and ongoing management of older adults and those with frailty. While most individuals with dementia can be assessed managed adequately in primary care settings, many individuals with dementia will require the supports of one or more geriatric or dementia specialists during the course of their illness for either clarification of diagnosis or management of complications or comorbidities associated with dementia⁴. Individuals with dementia may also receive physician services from neurologists in addition to specialists in geriatric medicine and geriatric psychiatry. At the current time there is limited information available about current access to these medical specialists for older adults, those living with dementia and frailty in Ontario and factors which lead to variation in access for speciality care. Understanding the physician workforce for older adults also requires an understanding of the current geriatric psychiatrist workforce in Ontario and projections for number of geriatric psychiatrists in Ontario in 2025 for the province of Ontario and for each LHIN to complement the work completed evaluating geriatric medicine specialists. Details about the current state of geriatric medicine, geriatric psychiatry and care of the elderly physicians are available in a separate report submitted by Dr. Michael Borrie and colleagues to the PGLO.

2. Methods

2.1 Data Sources

Administrative healthcare databases available at ICES-Queen's were used to complete this evaluation. Multiple databases available at ICES were linked to complete the analyses described in this report. These datasets were linked using unique encoded identifiers and analyzed at ICES-Queen's. The Registered Persons Database (RPDB) contains demographic information (age, sex) along with vital statistics (date of death) for all individuals in Ontario. The Ontario Health Insurance Plan (OHIP) database contains information related to all publicly funded physician services in Ontario include dates of physician services, diagnoses associated with services, location service, type of physician service provided, and specialty of the physician. The Canadian Institutes of Health Information (CIHI) Discharge Abstract Database (DAD) contains information on hospitalizations and the CIHI National Ambulatory Care Reporting System (CIHI-NACRS) contains information related to emergency department visits to Ontario Hospitals. The Ontario Drug Benefits (ODB) database contains information on prescribed medications for all individuals aged 65 and older in Ontario. Home care services were identified using the Home Care Database and the Home Care – Resident Assessment Instrument Databases. Disease specific databases are available at ICES for a range of common chronic health conditions (e.g. Ontario Diabetes Database, Congestive Heart Failure database) which were used to identify comorbid health conditions. The ICES Dementia database was used to identify the prevalent population of individuals with dementia (details of this algorithm are provided below). The LHIN database at ICES was used to create LHIN-level analyses of populations of interest.

2.2 Study Population

The population of interest for this report involved all adults in Ontario who had valid Ontario health insurance coverage on April 1, 2018 (the index date). The population was restricted to individuals age 66 and older to allow for a minimum of one year of information on prescribed medications in the ODB which only contains comprehensive information on prescribed medications for individuals age 65 and older. Individuals with a recorded age of >106 years were also excluded as this may represent coding errors in recording of their date of birth. We also excluded individuals with invalid or missing data on key variables and individuals who did not have continuous health insurance coverage during the analysis time period. Of the initial 2,736,076 individuals aged 66 and older in Ontario identified at the index date a total of 2,227,833 individuals remained in the overall study cohort of older adults following exclusion criteria.

2.3 Population Characteristics

The characteristics of the final study population were described. Demographic information was recorded including age category (66 – 75, 76 – 85, > 85 years) and sex at the index date. Place of residence (community or long-term care) was determined using long-term care (LTC) indicators contained in the Ontario Drug Benefits program. Overall medical comorbidity in the study population was described using the Charlson Comorbidity Index⁵ and the total number of unique medications prescribed in the year preceding the index date⁶. Specific medical and psychiatric comorbidities were recorded for the study population including: mood disorders, anxiety disorders, schizophrenia, substance use disorders, stroke,

Parkinson's disease, chronic obstructive pulmonary disease, ischemic heart disease, cardiac arrhythmias, congestive heart failure, diabetes, cancer and falls. Health service utilization in the year preceding the index date was recorded including number of days with any physician visits, number of emergency room (ER) visits, number of hospitalizations, and receipt of any home care services. The LHIN of residence was recorded for each individual.

2.3 Dementia Case Algorithm

The ICES dementia cohort definition uses a combination of hospitalizations, physician visits, and medications used in the treatment of dementia to identify individuals with dementia using administrative healthcare databases (see **Appendix 1** for details of the Dementia Algorithm)⁷. Any one or more of the following events in the two years preceding index was used to identify an individual as having dementia: one hospitalization with dementia as a main reason for admission, at least three physician visits separated by 30 days or greater within two years where dementia was recorded as the primary diagnosis; or, any prescription for a cholinesterase inhibitor (donepezil, galantamine, or rivastigmine). This algorithm has a sensitivity of 79%, specificity of 99%, positive predictive value of 80% and negative predictive value of 99% when compared to chart audits of family physician clinical records.

2.4 Frailty Case Algorithm

Ascertainment of frailty is typically determined using detailed clinical assessments of physical and cognitive functioning². Administrative healthcare databases typically do not contain detailed information on functional abilities except in certain clinical populations such as home care recipients and long-term care recipients where information contained in datasets such as the Resident Assessment Instrument (RAI) where frailty measures can be created using



functional information from the RAI^{8,9}. Restricting analyses of population-based estimates of frailty to only those individuals receiving home care or LTC services would underestimate the total number of individuals with frailty. Therefore, we used a frailty assessment method for use with physician and hospitalization data which is possible to assess on our entire study population¹⁰. Individuals are defined as frail in this algorithm if they are a resident in a long-term care facility (identified using ODB prescription indicators for LTC in the current study); if they were receiving palliative care services¹¹; or if they had two or more of the seven following conditions: cognitive impairment, incontinence, falls, nutritional difficulties, functional difficulties, targeted health service utilization, or functional difficulties (see **Appendix 2** for Frailty Case Definitions).

2.5 Characterization of Physician Services

The patterns of physician services involved in the care of older adults and those with dementia were described in the three populations of older adults. Specialists in geriatric medicine were identified using the main specialty designation of the physician in the OHIP database. At the present time there are no variables available in ICES data holdings which can distinguish between general psychiatrists and psychiatrist subspecialists including geriatric psychiatrists. Therefore, psychiatrist services are reported as receipt of any service by any psychiatrist although plans to link the physician geriatric psychiatrist database created for the PGLO specialist physician report to PGLO are in progress but require permission from the College of Physician and Surgeons of Ontario and Royal College of Physicians and Surgeons of Canada for data linkage which is in progress. Neurologist visits were restricted to the



subpopulation of individuals with dementia and identified through OHIP speciality designations. For each physician specialists we recorded the type of service using OHIP fee codes including new consultations, non-consultative direct clinical service, telemedicine, telephone consultation, e-consultation or team-based case conferencing (details available in **Appendix 3** for Physician Services Definitions). Each service was further categorized based on the where the physician provided the service including hospital (inpatient or ER), LTC, or community based settings. Service location prefixes in OHIP (i.e. “W” for long-term care services) and supplementary codes associated with travel (i.e. “C” for special visits to hospitals) were used to identify the location of physician visits.

3. Results

3.1 Overall Population of Older Adults in Ontario

There was a total of 2,275,833 adults aged 66 and older identified in Ontario on April 1, 2018 (**Table 1**). The median age of the population was 74 years and 55% of the population were female. Approximately 3.0% of the entire population (N= 68,548) resided in LTC facilities. General medical conditions and psychiatric conditions were common among older adults. In the year preceding the index date 89% of older adults had at least one physician visit, 24% had an ER visit, 11% were hospitalized and 14% received any home care services. The total number of older adults varied from 287,749 individuals in the Central LHIN (13% of all older adults) to 41,803 (2% of all older adults) in the North West LHIN. The characteristics of older adults in each LHIN is available in **Supplementary Data File 1** provided with this report.



Table 1 Baseline Characteristics of Ontario Population Age 66 years and Older

Characteristic	Total = 2,275,833 Number (%)
Age	
Median (IQR)	74 (69-81)
65 - 74	1,202,732 (52.8)
75 - 84	733,355 (32.2)
85 +	339,746 (14.9)
Gender	
Male	1,036,202 (45.5)
Female	1,239,631 (54.5)
Location of Residence	
Community-dwelling	2,207,285 (97.0)
Long-term care	68,548 (3.0)
Total number of unique medications, Mean \pmSD	7.26 \pm 5.76
History of Medical Conditions, N (%)	
Stroke	430,596 (18.9)
Parkinson's Disease	21,217 (0.9)
Chronic obstructive lung disease	449,421 (19.7)
Cardiac arrhythmia	349,067 (15.3)
Ischemic heart disease	114,478 (5.0)
Congestive Heart Failure	206,280 (9.1)
Diabetes mellitus	674,618 (29.6)
Cancer	388,982 (17.1)
Falls	
<i>Any emergency department visit</i>	81,806 (3.6)
<i>Any hospitalization</i>	18,880 (0.8)
Substance related disorders	91,822 (4.0)
Schizophrenia/Psychotic disorders	21,019 (0.9)
Mood disorders	174,366 (7.7)
Anxiety disorders	630,798 (27.7)
Health Service Utilization	
Any physician visit in previous year	2,031,681 (89.3)
Number of physician visits, Median (IQR)	7 (3-12)
Any emergency department visit	555,546 (24.4)
Any acute care hospitalizations	248,878 (10.9)
Any homecare services	311,072 (13.7)
LHIN	
Erie St. Clair	117,559 (5.2)
South West	177,498 (7.8)
Waterloo Wellington	113,817 (5.0)

Hamilton Niagara Haldimand Brant	267,894 (11.8)
Central West	121,681 (5.3)
Mississauga Halton	169,389 (7.4)
Toronto Central	179,592 (7.9)
Central	287,749 (12.6)
Central East	272,574 (12.0)
South East	105,154 (4.6)
Champlain	219,213 (9.6)
North Simcoe Muskoka	89,808 (3.9)
North East	112,102 (4.9)
North West	41,803 (1.8)

3.2 Older Adults with Dementia in Ontario

The total population of individuals with physician diagnosed dementia was 173,205 individuals or 7.6% of the entire Ontario population (**Table 2**). The median age of the population was 84 years and 63% of the population were female. Approximately 33% of the entire dementia population (N= 56,836) resided in LTC facilities. General medical conditions and psychiatric conditions were common among older adults with dementia and higher rates of most conditions were reported among individuals with dementia compared the entire population of older adults in Ontario. In the year preceding the index date 96% of older adults had at least one physician visit, 36% had at least one ER visit, 24% were hospitalized and 48% received any home care services. The total number of older adults with dementia varied from 22,388 individuals in the Central LHIN (13% of all older adults) to 3,324 individuals (2% of all older adults) in the North West LHIN. The characteristics of older adults in each LHIN is available in **Supplementary Data File 2** provided with this report.

Table 2 Characteristics of Older Adults with Physician Diagnosed Dementia in Ontario

Characteristic	Total = 173,205 Number (%)
Age	
Median (IQR)	82 (75-88)
65 - 74	25,279 (14.6)
75 - 84	63,904 (36.9)



85 +	84,022 (48.5)
Gender	
Male	64,630 (37.3)
Female	108,575 (62.7)
Location of Residence	
Community-dwelling	116,369 (67.2)
Long-term care	56,836 (32.8)
Total number of unique medications Mean ±SD	11.27 ± 6.49
Charlson Comorbidity Index Median (IQR)	0 (0-1)
History of Medical Conditions	
Stroke	52,029 (30.0)
Parkinson's Disease	7,379 (4.3)
Chronic obstructive lung disease	48,331 (27.9)
Cardiac arrhythmia	47,939 (27.7)
Ischemic heart disease	12,132 (7.0)
Congestive Heart Failure	33,774 (19.5)
Diabetes mellitus	62,012 (35.8)
Cancer	34,629 (20.0)
Falls	
<i>Any emergency department visit</i>	16,287 (9.4)
<i>Any hospitalization</i>	5,899 (3.4)
Substance related disorders	16,842 (9.7)
Schizophrenia/Psychotic disorders	7,577 (4.4)
Mood disorders	33,836 (19.5)
Anxiety disorders	78,719 (45.4)
Health Service Utilization	
Any physician visit in previous year	165,648 (95.6)
Number of physician visits, Median (IQR)	12 (6-16)
Any emergency department visit	62,524 (36.1)
Any acute care hospitalization	40,870 (23.6)
Any homecare service	83,264 (48.1)
LHIN	
Erie St. Clair	8,482 (4.9)
South West	12,137 (7.0)
Waterloo Wellington	8,169 (4.7)
Hamilton Niagara Haldimand Brant	19,831 (11.4)
Central West	7,572 (4.4)
Mississauga Halton	12,592 (7.3)
Toronto Central	16,356 (9.4)
Central	22,388 (12.9)
Central East	21,984 (12.7)
South East	7,641 (4.4)
Champlain	18,168 (10.5)
North Simcoe Muskoka	6,414 (3.7)
North East	8,147 (4.7)
North West	3,324 (1.9)

3.3 Characteristics of Older Adults with Frailty In Ontario

The total population of individuals with frailty was 314,319 individuals or 13.8% of the entire Ontario population (**Table 3**). The median age of the population was 82 years and 60% of the population were female. Approximately 22% of the entire frail population (N= 68,548) resided in LTC facilities. General medical conditions and psychiatric conditions were common among older adults with frailty and higher rates of most conditions were reported among individuals with frailty compared the entire population of older adults in Ontario. In the year preceding the index date 99% of older adults had at least one physician visit, 50% had at least one ER visit, 49% were hospitalized and 56% received any home care services. The total number of older adults with frailty varied from 38,125 individuals in the Central LHIN (12% of all older adults with frailty) to 7,041 individuals (2% of all older adults with frailty) in the North West LHIN. The characteristics of older adults in each LHIN is available in **Supplementary Data File 3** provided with this report.

Table 3 Characteristics of Older Adults with Frailty in Ontario

Characteristic	Total =314,319 Number (%)
Age	
Median (IQR)	82 (75-88)
66 - 74	75,291 (24.0)
75 - 84	114,413 (36.4)
85 +	124,615 (39.6)
Gender	
Male	125,205 (39.8)
Female	189,114 (60.2)
Location of Residence	
Community-dwelling	245,771 (78.2)
Long-term care	68,548 (21.8)
Total number of unique medications Mean ±SD	12.89 ± 6.56
Charlson Comorbidity Index Median (IQR)	1 (0-2)



History of Medical Conditions	
Stroke	118,819 (37.8)
Parkinson's Disease	10,061 (3.2)
Chronic obstructive lung disease	101,367 (32.2)
Cardiac arrhythmia	106,751 (34.0)
Ischemic heart disease	27,005 (8.6)
Congestive Heart Failure	82,126 (26.1)
Diabetes mellitus	122,614 (39.0)
Cancer	82,534 (26.3)
Falls	
Any Emergency Department Visit	31,790 (10.1)
Any hospitalization	16,978 (5.4)
Substance related disorders	32,476 (10.3)
Schizophrenia/Psychotic disorders	11,018 (3.5)
Mood disorders	55,214 (17.6)
Anxiety disorders	137,315 (43.7)
Health Service Utilization	
Any physician visit in previous year	309,942 (98.6)
Number of physician visits, Median (IQR)	13 (8-20)
Any emergency department visit	156,803 (49.9)
Any acute care hospitalizations	154,195 (49.1)
Any homecare services	176,795 (56.2)
LHIN	
Erie St. Clair	15,464 (4.9)
South West	25,611 (8.1)
Waterloo Wellington	15,493 (4.9)
Hamilton Niagara Haldimand Brant	37,378 (11.9)
Central West	14,349 (4.6)
Mississauga Halton	21,819 (6.9)
Toronto Central	28,143 (9.0)
Central	38,125 (12.1)
Central East	35,352 (11.2)
South East	14,244 (4.5)
Champlain	30,896 (9.8)
North Simcoe Muskoka	12,793 (4.1)
North East	17,611 (5.6)
North West	7,041 (2.2)

3.4 Utilization of Physician Services

Among all older adults in Ontario, 2.0% received any services from a Geriatric Medicine specialist in the year preceding their index date (**Table 4**). The proportion of individuals with dementia and frailty who received any Geriatric Medicine services was 17% and 12%, respectively. The outpatient setting was the most common setting for physician services, followed by hospital and long-term care. E-consults and telemedicine were infrequently used methods of clinical assessment by Geriatric Medicine specialists. Psychiatrists provided services to 2.7% of all older adults and 11% of individuals with dementia and 8.5% of individuals with frailty (**Table 5**). The community setting was also the most common setting for psychiatric services followed by hospital and long-term care. Telephone consults, e-consults and telemedicine consults were infrequently used by psychiatrists. The analysis of Neurologist visits was restricted to individuals with dementia and 11% of individuals with dementia received any services from a neurologist in the preceding year (**Table 6**). Most neurologist visits were in community and hospital settings and utilization of telemedicine, e-consults and telephone consults were uncommon.

Table 4 Geriatric Medicine Services for Older Adults, Older Adults with Dementia and Frailty

Overall Population	N= 2,275,833
Any visit	46,855 (2.1)
Community	
Any community consults	23,932 (1.1)
Any community non-consultative care	22,356 (1.0)
Hospital	
Any hospital consults	7,062 (0.3)
Any hospital non-consultative care	2,497 (0.1)
Long Term Care	
Any LTC consult	619 (0.0)
Any LTC non-consultative care	420 (0.0)



Other	
Telemedicine consults, any service	0
Case conference, any service	2,142 (0.1)
Telephone consultation	1,476 (0.1)
E-consultation	10 (0.0)
Any visit	6 (0.0)
Dementia Population	N= 173,205
Any visit	29,485 (17.0)
Community	
Any community consults	13,551 (7.8)
Any community non-consultative care	17,648 (10.2)
Hospital	
Any hospital consults	3,125 (1.8)
Any hospital non-consultative care	1,254 (0.7)
Long Term Care	
Any LTC consult	503 (0.3)
Any LTC non-consultative care	364 (0.2)
Other Services	
Telemedicine consults, any service	0
Case conference	1,416 (0.8)
Telephone consultation	1,281 (0.7)
E-consultation	<=5 (0.0)
Any other visit	6 (0.0)
Frailty Population	N= 314,319
Any visit	37,447 (11.9)
Community	
Any community consults	18,493 (5.9)
Any community non-consultative care	18,142 (5.8)
Hospital	
Any hospital consults	6,557 (2.1)
Any hospital non-consultative care	2,385 (0.8)
Long Term Care	
Any LTC consult	612 (0.2)
Any LTC non-consultative care	416 (0.1)
Other	
Telemedicine consults, any service	0
Case conference, any service	1,749 (0.6)
Telephone consultation	1,376 (0.4)
E-consultation	8 (0.0)
Any other visit	6 (0.0)



Table 5 Psychiatrist Services for Older Adults, Older Adults with Dementia and Frailty

Overall Population	N=2,275,833
Any visit	62,395 (2.7)
Community	
Any community consults	20,448 (0.9)
Any community non-consultative care	43,182 (1.9)
Hospital	
Any hospital consults	4,906 (0.2)
Any hospital non-consultative care	9,208 (0.4)
Long Term Care	
Any LTC consult	3,423 (0.2)
Any LTC non-consultative care	70 (0.0)
Other	
Telemedicine consults, any service	0
Case conference, any service	959 (0.0)
Telephone consultation	202 (0.0)
E-consultation	16 (0.0)
Any other visit	1,145 (0.1)
Dementia Population	N=173,205
Any visit	19,225 (11.1)
Community	
Any community consults	6,192 (3.6)
Any community non-consultative care	10,647 (6.1)
Hospital	
Any hospital consults	1,884 (1.1)
Any hospital non-consultative care	4,736 (2.7)
Long Term Care	
Any LTC consult	3,061 (1.8)
Any LTC non-consultative care	70 (0.0)
Other	
Telemedicine consults, any service	0
Case conference, any service	432 (0.2)
Telephone consultation	66 (0.0)
E-consultation	8 (0.0)
Any other visit	494 (0.3)
Frailty Population	N=314,319
Any visit	26,766
Community	
Any community consults	9,148 (2.9)
Any community non-consultative care	14,192 (4.5)
Hospital	
Any hospital consults	3,683 (1.2)
Any hospital non-consultative care	7,583 (2.4)
Long Term Care	
Any LTC consult	3,357 (1.1)

Any LTC non-consultative care	70 (0.0)
Other	
Telemedicine consults, any service	0
Case conference, any service	576 (0.2)
Telephone consultation	131 (0.0)
E-consultation	7 (0.0)
Any other visit	803 (0.3)

Table 6 Neurologist Services for Older Adults with Dementia

Dementia Population	N =173,205
Any visit	19,247 (11.1)
Community	
Any community consults	10,898 (6.3)
Any community non-consultative care	12,416 (7.2)
Hospital	
Any hospital consults	2,998 (1.7)
Any hospital Non-consultative care	459 (0.3)
Long Term Care	
Any LTC consult	157 (0.1)
Any LTC non-consultative care	238 (0.1)
Other	
Telemedicine consults, any service	0
Case conference, any service	0
Telephone consultation	265 (0.2)
E-consultation	12 (0.0)
Any other visit	<=5 (0.0)

3.5 Data Limitations

There are limitations to this data which should be considered when interpreting the results. The methods used to identify dementia and frailty rely on health service encounters where diagnostic codes related to dementia or frailty are recorded during routine clinical care. As such these methods will likely underestimate the true prevalence of dementia and frailty in the population as it is known that up to 60% of individuals with dementia are not diagnosed¹². Estimates of the numbers of people affected by dementia in Ontario using epidemiological studies indicate that approximately 225,000 individuals in Ontario have an underlying dementia when compared 173,000 identified using administrative databases. Similarly, estimates of the frailty in Ontario indicate that up to 450,000 individuals in Ontario



have a significant degree of frailty in comparison to the 314,000 individuals identified using administrative healthcare databases. It is also unclear whether the biases in the estimates of disease prevalence may be different in different health regions and as such the degree to which case ascertainment algorithms underestimate conditions such as dementia or frailty may also differentially affect estimates in different health regions. Another limitation relates to capturing services provided by geriatric psychiatrists in Ontario. At the present time there is no way to distinguish between services provided by general psychiatrists and geriatric psychiatrists using administrative data which may overestimate the numbers of services provided by geriatric psychiatrists to our populations of interest. Some psychiatrists are also paid through mechanisms other than OHIP (i.e. salaried positions associated with former provincial psychiatric hospitals). Our analysis was restricted to individuals age 66 which will not capture individuals with early onset dementia or individuals who develop frailty earlier in life who may also benefit from SGS.

4. Summary

This report provides an overview of the current numbers of older adults in Ontario (2.2 million) and the estimates of the numbers of older adults living with dementia (173,000) and frailty (314,000). The findings of this analysis outline the current need for SGS in Ontario and highlight complexity of older adults including a high prevalence of medical, psychiatric and functional disorders in this population. Given the relatively limited availability of physician specialist services for this population at the current time, efforts to optimize the physician workforce in terms of both the numbers of physicians practicing in Geriatric Medicine and Geriatric Psychiatry should be considered along with enhancements to interdisciplinary models of care to improve access to SGS. Future work should also consider improving the quality of data available for health system planning to better capture older adults with complex conditions such as dementia and frailty.

5. Acknowledgments

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Appendices

Appendix 1: Dementia Case Ascertainment Algorithm

Database	Variable name in database	Value
OHIP	DXCODE	290, 331, 797
CIHI-DAD	DXTYPE1-25	M, 1, 2, 3
	DX10CODE1-25	F00X (any code starting with F00); F01X (any code starting with F01); F02X (any code starting with F02); F03; G30XX (any code starting with G30) including: F00.0, F00.1, F00.2, F00.9, F01.0, F01.1, F01.2, F01.3, F01.8, F01.9, F02.0, F02.1, F02.2, F02.3, F02.4, F02.8, F03.X, F05.1, F06.5, F06.6, F06.8, F06.9, F09.X, G300.0, G30.1, G30.8, G30.9, G31.0 G31.1, R54.X
OMHRS	DX10CODE1-10	290.40, 290.42, 290.43, 294.10, 294.80, 294.90, 780.90
ODB	DIN	<p><u>Donepezil</u>: 02397595, 02397609, 02397617, 02397625, 02328666, 02328682, 02367688, 02367696, 02428482, 02428490</p> <p><u>Galantamine</u>: 02293021, 02293048, 02293056, 02425157, 02425165, 02425173, 02295229, 02295237, 02295245, 02416573, 02416581, 02416603, 02443015, 02443023, 02443031, 02420821, 02420848, 02420856, 02339439, 02339447, 02339455, 02316943, 02316951, 02316978, 02333376, 02333384, 02333392, 02398370, 02398389, 02398397, 02270773, 02270781, 02270803, 02244298, 02244299, 02244300, 02244302, 82244299, 82244300, 02266717, 02266725, 02266733, 02377950, 02377969, 02377977, 02295229, 02295237, 02295245</p> <p><u>Rivastigmine</u>: 02423537, 02423529, 02336715, 02336723, 02336731, 02336758, 02427567, 02427575, 02427583, 02427591, 02307685, 02307693, 02307707, 02307715, 02242115, 02242116, 02242117, 02242118, 02245240, 82242115, 82242116, 02302853, 02432803, 02302845, 02401614, 02401622, 02401630, 02401649, 02406985, 02406993, 02407000, 02407019, 02332809, 02332817, 02332825, 02332833, 02423413, 02423421, 02308169,</p>



		02308177, 02308185, 02308193, 02306034, 02306042, 02306050, 02306069, 02311283, 02311291, 02311305, 02311313, 02312492, 02312506, 02312514, 02312522, 02416999, 02417006, 02417014, 02417022, 02375729, 02375737, 02375745, 02375753, 02426307, 02426293, 02324563, 02324571, 02324598, 02324601, 02305984, 02305992, 02306018, 02306026, 02308622, 02308630, 02308649, 02308657
DEMENTIA	DIAGDATE	-

Appendix 2: Frailty Case Ascertainment Algorithm

Variable	Database	Variable name in database	Value
Individuals in long term care	ODB	LTC	-
Individuals receiving palliative care	CIHI-DAD	DX10CODE1-25	Z515
		PATSERV	58
		PRVSERV [1-8]	00121
		INSERV [1-20]	00121
	OHIP	DXCODE	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 [1-10]	00121
		CONSULTSERV3	00121
	HCD	SRC-admission	95
		Service_RPC	95
		SRC_discharge	95
		Residence_type	2000
	RAICA	B2C	1
		B4	12
Cognitive impairment			
Dementia	OHIP	DXCODE	290, 331, 797
	CIHI-DAD	DXTYPE1-25	M,1, 2, 3
		DX10CODE1-25	F00X (any code starting with F00); F01X (any code starting with F01); F02X (any code starting with F02); F03; G30XX (any code starting with G30) including: F00.0, F00.1, F00.2, F00.9, F01.0, F01.1, F01.2, F01.3, F01.8, F01.9, F02.0, F02.1, F02.2, F02.3, F02.4, F02.8, F03.X, F05.1, F06.5, F06.6, F06.8, F06.9, F09.X, G300.0, G30.1, G30.8, G30.9, G31.0 G31.1, R54.X



	OMHRS	DX10CODE1-10	290.40, 290.42, 290.43, 294.10, 294.80, 294.90, 780.90
	ODB	DIN	<u>Donepezil:</u> 02397595, 02397609, 02397617, 02397625, 02328666, 02328682, 02367688, 02367696, 02428482, 02428490
			<u>Galantamine:</u> 02293021, 02293048, 02293056, 02425157, 02425165, 02425173, 02295229, 02295237, 02295245, 02416573, 02416581, 02416603, 02443015, 02443023, 02443031, 02420821, 02420848, 02420856, 02339439, 02339447, 02339455, 02316943, 02316951, 02316978, 02333376, 02333384, 02333392, 02398370, 02398389, 02398397, 02270773, 02270781, 02270803, 02244298, 02244299, 02244300, 02244302, 82244299, 82244300, 02266717, 02266725, 02266733, 02377950, 02377969, 02377977, 02295229, 02295237, 02295245
			<u>Rivastigmine:</u> 02423537, 02423529, 02336715, 02336723, 02336731, 02336758, 02427567, 02427575, 02427583, 02427591, 02307685, 02307693, 02307707, 02307715, 02242115, 02242116, 02242117, 02242118, 02245240, 82242115, 82242116, 02302853, 02432803, 02302845, 02401614, 02401622, 02401630, 02401649, 02406985, 02406993, 02407000, 02407019, 02332809, 02332817, 02332825, 02332833, 02423413, 02423421, 02308169, 02308177, 02308185, 02308193, 02306034, 02306042, 02306050, 02306069, 02311283, 02311291, 02311305, 02311313, 02312492, 02312506, 02312514, 02312522, 02416999, 02417006, 02417014, 02417022, 02375729, 02375737, 02375745, 02375753, 02426307, 02426293, 02324563, 02324571, 02324598, 02324601, 02305984, 02305992,



			02306018, 02306026, 02308622, 02308630, 02308649, 02308657
	DEMENTIA	DIAGDATE	-
Delirium	DAD	DX10CODE1-25	F05X: F050, F051, F058, F059
	OHIP	DXCODE	293
General health status			
Non-elective hospital admissions	DAD	ADMDATE	-
	OHIP	ADMDATE	-
Emergency visit	DAD	ADMCAT	E
	OHIP	LOCATION	E
Malaise and fatigue/debility	DAD	DX10CODE1-25	R53, G933
	OHIP	DXCODE	795
Cachexia	DAD	DX10CODE1-25	R64
Incontinence			
Urinary incontinence	DAD	DX10CODE1-25	R32
Fecal incontinence	DAD	DX10CODE1-25	R15
Falls associated with hospitalization	DAD	DX10CODE1-25	E9177, E9178, E9293, W01, W05-W19
	OHIP	DXCODE	
Nutrition issues			
Abnormal weight loss; underweight; feeding difficulties; anorexia; other symptoms and signs concerning food and fluid intake	DAD	DX10CODE1-25	R634, R633, R630, F500, F501, R63, R636, R638, 78322, 7833, 7839
Failure to thrive	DAD	DX10CODE1-25	R627
Functional performance			
Abnormality of gait	DAD	DX10CODE1-25	R26
Difficulty in walking	DAD	DX10CODE1-25	R262
Muscular wasting and disuse atrophy	DAD	DX10CODE1-25	M6250-9
Muscular weakness	DAD	DX10CODE1-25	M6281
Pressure ulcer	DAD	DX10CODE1-25	L89X
Targeted health service utilization			
Geriatrician billing claim	OHIP	OHSPEC	07
		FEEDCODE	W770, W775, W795, A770, A775, A795, C770, C775, C795, E071, E075, E077, E703
Geriatrician service claim	DAD	PATSERV	77
Provider home visit	OHIP	LOCATION	H



		FEECODE	B960-4, B966, B986, B987, B988, B990-8
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Appendix 3: Physician Services Algorithm

Variable	Database	Variable name in database	Value
Geriatric Medicine Services			
Any visit	OHP	OHSPEC	7
	IPDB	MAINSPECIALTY	Geriatric Medicine
Visits at long term care			
Consultative care	OHIP	LOCATION	L
		FEECODE	W075, W375, W076, W770, W775, C775, A775, A770, A075, A070, A375, A076
Non-consultative care	OHIP	LOCATION	L
		FEECODE	W272, W274, W277, W279, W074, W072, W071, W982, W073, W078, W972, W121, W010, E071, E075, E070, A073, A074, A071, A078
Visits at hospital			
Consultative care	OHIP	LOCATION	I, E
		FEECODE	C770, C775, C075, C375, C076, A775, A195, A895, A770, A075, A070, A375, A076
Non-consultative care	OHIP	LOCATION	I, E
		FEECODE	C073, C074, C071, C072, C077, C079, C122, C123, C124, C142, C143, C121, C078, C982, E071, E075, E070, A073, A074, A071, A078
Visits at community-dwelling			
Consultative care	OHIP	LOCATION	H, O, P
		FEECODE	C775, A775 A770, A075, A375, A076
Non-consultative care	OHIP	LOCATION	H, O, P
		FEECODE	B986, B987, B988, E071, E075, E070, E078 A073, A074, A071, A078
Other visits			
Case Conference	OHIP	FEECODE	K701, K703
Telephone Consultation	OHIP	FEECODE	K731, K077
E-consultation	OHIP	FEECODE	K739
Telemedicine consults	OHIP	FEECODE	B100A, B200A, B099A
Assessments under the mental health act	OHIP	FEECODE	K620, K623, K624, K629
Psychiatrist Services			
Any visit	OHP	SPEC	19
	IPDB	MAINSPECIALTY	Psychiatry
Visits at long term care			



Consultative care	OHIP	LOCATION	L
		FEECODE	W795, W695, W190, W895, W395, W196, C795, A795, W895, K895, K620, A195, A191, A192, A190, W190, W795, A795, K630, W395, W196, A895, A795, A695, A395, A196
Non-consultative care	OHIP	LOCATION	
		FEECODE	K198, K190, K196, K197, K195, K187, K188, K189, K203, K204, K205, K206, K208, K209, K192, K194, K623, K624, K629, A193, A194
Visits at hospital			
Consultative care	OHIP	LOCATION	I, E
		FEECODE	C795, C895, C190, C395, C196, C695, A795, A195, A191, A192, A190, C190, C395, C196, K620, K630, A895, A795, A695, A395, A196
Non-consultative care	OHIP	LOCATION	I, E
		FEECODE	C193, C194, C192, C197, C199, C122, C123, C124, C142, C143, C121, C198, C982, K199, K191, k190, K193, K200, K201, K202, K207, K210, K211, K192, K194, K623, K624, K629, A193, A194
Visits at community-dwelling			
Consultative care	OHIP	LOCATION	H, O, P
		FEECODE	C795 and A795, K620, A195, A191, A192, A190, A795, A395, A196, K630, A795, A695
Non-consultative care	OHIP	LOCATION	H, O, P
		FEECODE	K187, K188, K189, K198, K190, K197, K195, A193, A194, K196, K203, K204, K205, K206, K208, K209, K192, K194, K623, K624, K629
Other visits			
Case Conference	OHIP	FEECODE	K701, K703
Telephone Consultation	OHIP	FEECODE	K731, K077
E-consultation	OHIP	FEECODE	K739
Telemedicine consults	OHIP	FEECODE	B100A, B200A, B099A
Assessments under the mental health act	OHIP	FEECODE	K620, K623, K624, K629
Neurologist Services			
Any visit	OHP	OHSPEC	18
	IPDB	MAINSPECIALTY	Neurology
Visits at long term care			
Consultative care	OHIP	LOCATION	L



		FEEDCODE	W113, W180, W667, W667, W185, W186, W046, W385, C186, A180, A185, A186, A188, A385
Non-consultative care	OHIP	LOCATION	L
		FEEDCODE	W982, W972, W121, W181, W182, W183, W188, W184, W113, A113, C510, K032, A113, A510, A183, A184, A181, A188, E078
Visits at hospital			
Consultative care	OHIP	LOCATION	I, E
		FEEDCODE	C113, C180, C667, C180, C185, C186, A185, A186, A188, A385, C385, A180
Non-consultative care	OHIP	LOCATION	I, E
		FEEDCODE	E078, A183, A184, A113, A181, A188, C510, K032, A113, A510, C113, C183, C184, C181, C113, C122, C123, C124, C142, C143, C121, C188, C982, C182, C187, C189, C188
Visits at community-dwelling			
Consultative care	OHIP	LOCATION	H, O, P
		FEEDCODE	C186, A185, A186, A188, A385, A180
Non-consultative care	OHIP	LOCATION	H, O, P
		FEEDCODE	E078, A667, A183, A184, A181, A188, A113, C510, K032, A113, A510
Other visits			
Case Conference	OHIP	FEEDCODE	K701
Telephone Consultation	OHIP	FEEDCODE	K731
E-consultation	OHIP	FEEDCODE	K739
Telemedicine consults	OHIP	FEEDCODE	B100A, B200A, B099A
Assessments under the mental health act	OHIP	FEEDCODE	K620, K623, K624, K629
Geriatric Psychiatrist Services			
Any visit	OHP	SPEC	=19
	IPDB	MAINSPECIALTY	Psychiatry
Visits at long term care			
Consultative care	OHIP	LOCATION	L
		FEEDCODE	W795, W695, W190, W895, W395, W196, C795, A795, W895, K895, K620, A195, A191, A192, A190, W190, W795, A795, K630, W395, W196, A895, A795, A695, A395, A196
	OHIP	LOCATION	L



Non-consultative care		FEECODE	K198, K190, K196, K197, K195, K187, K188, K189, K203, K204, K205, K206, K208, K209, K192, K194, K623, K624, K629, A193, A194
Visits at hospital			
Consultative care	OHIP	LOCATION	I, E
		FEECODE	C795, C895, C190, C395, C196, C695, A795, A195, A191, A192, A190, C190, C395, C196, K620, K630, A895, A795, A695, A395, A196
Non-consultative care	OHIP	LOCATION	I, E
		FEECODE	C193, C194, C192, C197, C199, C122, C123, C124, C142, C143, C121, C198, C982, K199, K191, K190, K193, K200, K201, K202, K207, K210, K211, K192, K194, K623, K624, K629, A193, A194
Visits at community-dwelling			
Consultative care	OHIP	LOCATION	H, O, P
		FEECODE	C795, A795, K620, A195, A191, A192, A190, A795, A395, A196, K630, A795, A695
Non-consultative care	OHIP	LOCATION	H, O, P
		FEECODE	K187, K188, K189, K198, K190, K197, K195, A193, A194, K196, K203, K204, K205, K206, K208, K209, K192, K194, K623, K624, K629
Other visits			
Case Conference	OHIP	FEECODE	K701, K703
Telephone Consultation	OHIP	FEECODE	K731, K077
E-consultation	OHIP	FEECODE	K739
Telemedicine consults	OHIP	FEECODE	B100A, B200A, B099A
Assessments under the mental health act	OHIP	FEECODE	K620, K623, K624, K629