Physician Home Visits in Ontario: Trends over Time and Patient Characteristics

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ABSTRACT

Background: Physician home visits ensure that access to primary and palliative care is not limited to those who can visit an office setting. It is unknown how home visits have changed over time, and in response to payment incentives. We measured the use of physician home visits in Ontario from 2005 to 2018, and described the characteristics of patients who received them.

Methods: We conducted a retrospective study using health administrative data in Ontario, Canada. We first examined annual population-level home visit volumes and costs from 2005-2018, categorized as palliative, homecare services recipient, or other. We then compared the sociodemographic and healthcare utilization characteristics of home visit recipients between groups.

Results: More than half (51.6%) of physician home visits from 2005-2018 were provided to patients who were neither palliative nor receiving homecare services. This group of patients was younger, had fewer comorbidities and lower rates of healthcare utilization before and after the visit than those in the palliative or homecare services groups. Only 28% of these visits were with the patient's enrolling primary care physician or a physician in the same group, and only 39% were with a physician they had seen in the previous year.

Interpretation: A large proportion of physician home visits in Ontario are provided to patients who are young, have few-to-no comorbidities, and low health services utilization before and after the home visit. This suggests an opportunity to refine policy tools to precisely target patients who are most likely to benefit from home visits.

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INTRODUCTION

Homebound individuals face challenges accessing preventive, chronic, and acute care, leading to adverse health effects and an over-reliance on emergency and hospital-based services.[1,2] Home-based primary care[3] can reduce the use of emergency department visits and hospitalizations for homebound older adults,[4-7] provide essential information about patients' needs and home life[8], and is perceived positively by patients, caregivers and providers.[9-11] For many homebound older adults, strengthening primary care at home has the twin benefits of shifting care out of hospitals and also delaying the need for residential long-term care.[12] Similarly, patients near the end of life have complex health needs yet often prefer to spend their last days at home with loved ones rather than in a residential hospice setting.[13] Physician home visits may also increase the likelihood of death occurring at home.[14,15]

Access to physician home visits is essential to meet the needs of palliative and other homebound patients. While rates are still declining in some regions, financial incentives have driven a resurgence in physician home visits in the United States.[16-18] Yet, fee-for-service or other volume-based incentives may also reward providers and companies that aim to maximise profits by offering short, low-complexity visits of convenience, disconnected from patients' existing health care team. It is unknown how much of current physician home visit volume is driven by low-complexity or low-continuity visits. We measured the use of physician home visits in Ontario from 2005 to 2018, and describe the sociodemographic and healthcare usage profiles of patients who received them. We hypothesized that many recipients of physician home visits were neither palliative nor receiving homecare services, and aimed to explore this group's characteristics.

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METHODS

Setting

Ontario is Canada's most populous province, with over 14.5 million residents, accounting for over 38% of Canada's total population. Public health insurance is provided without premium or co-pay through the Ontario Health Insurance Program (OHIP). Overall 93% of Ontario residents report having a primary care provider with 82% formally enrolled to a physician working in a Patient Enrolment Model[19] –a model where physicians work in groups, have shared responsibility for after-hours care, and receive some blended payments and incentives. Primary care physicians not practicing in a patient enrolment model work independently and are paid fee-for-service.[20]

To incentivize the provision of physician home visits, the Ontario Ministry of Health has long offered special visit premiums for visits in a home setting. However, in 2005, a special visit premium was introduced for palliative home visits with a dollar value three times that of the corresponding code for a regular home visit. [21] In 2012, additional annual bonus payments were introduced, paying physicians who provide the highest volume of non-palliative, primary care home visits up to an additional $8,000 annually.[22]

Study Design and Data Sources

This retrospective study used health administrative datasets linked using unique encoded identifiers and analyzed at ICES in Ontario, Canada. We included a descriptive analysis of changes in physician home visits over time and a patient-level analysis to understand characteristics of those receiving home care.

ICES holds information on physician and emergency department visits, hospital stays, and publicly-funded home healthcare in Ontario (see Appendix 1 for details). Because of the universal nature of healthcare coverage under OHIP, this study was population-based. It was also exempt from Ethics review under section 45 of Ontario's Personal Health Information Protection Act.

Study Population

For our population-level analysis of physician home visits over time, we included all Ontario residents with a valid health card with at least one physician home visit between April 1st 2005 to March 31st, 2019. A physician home visit was defined using a combination of dedicated home visit billing codes and other assessment codes with a location of "home" (see Appendix 2 for detailed definition).

For our patient-level analysis, we further narrowed the inclusion period to April 1st 2014 - March 1st, 2019. We selected the first physician home visit per patient and excluded all others (Flowchart in Appendix Figure 1).

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Measures

Stratification of physician home visits

We categorized physician home visits by the type of recipient (palliative, homecare services, other). We used billing codes to determine if the visit was palliative (Appendix Table 2). We categorized recipients as receiving homecare services if they had received two or more services in the previous 30 days. Homecare services involve personal support workers, nurses, or other allied health professionals, but not physicians. We used homecare services as a proxy for a level of functional impairment that would impede attendance at medical appointments outside a home setting.

Trends over time

We measured the annual total value of physician home visit billings, which was the sum of all billing claims resulting from an encounter with at least one home visit code. We used Statistics Canada's Ontario population estimates to calculate the annual rate of physician home visits per 10,000 people.[23]

Patient characteristics and health system use

Patient-level baseline characteristics included demographics: age, sex, urban/rural residence[24], census-based neighborhood income quintile, immigrant status[25], and limited proficiency in English or French (available for all immigrants landing in Ontario after 1985). We also included count of comorbidities over the previous 2 years using Johns Hopkins Aggregated Diagnosis Groups[26] (ADG), healthcare utilization over the previous 2 years grouped into low (0-2), moderate (3), and high (4-5) Resource Utilization Bands[26] (RUB), emergency department visits in the previous 30 days, hospital discharge in the previous 30 days, count of outpatient physician visits in the previous year, homecare services in the previous 30 days, emergency department visit or hospitalization for a mental health condition in the previous two years [27], history of dementia[28], asthma[29,30], diabetes[31], chronic obstructive pulmonary disease[32], heart failure[33], or post-partum status.[34] We also included information on primary care attachment (see Appendix Table 3 for operational definition of all variables).

The Resident Assessment Instrument – Homecare (RAI-HC) is a validated tool covering social, functional and health dimensions.[35-37] This tool is used for the approximately 40% of Ontario homecare service recipients who are "long-stay" or expected to have care needs beyond 60 days and is typically completed every 6 months.[38-40] For the subgroup of patients who had a RAI-HC assessment completed within 6 months before the index home visit, we reported whether the recipient had hearing impairment, vision impairment, a caregiver in the home, use of an assistive device, dependency for locomotion, as well as their homebound status.

We included the following variables relating to relational continuity between patient and physician: whether the patient was formally enrolled to the home visiting physician, whether

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the patient was enrolled to a physician in the same group as the home visiting physician, and whether the patient was known to the home visiting physician from another encounter in the previous year. In addition, we reported patient events following the index physician home visit: repeat home visits in the subsequent year and office physician visit, emergency department visit or urgent hospitalization within 30 days.

Data Analyses

First, we plotted the annual count of home visits per 10,000 Ontarians and the annual total cost of physician home visit billings over time, stratified by type of recipient (palliative, homecare service recipient, or other).

In our patient-level analysis, we described baseline, patient-physician dyad, and post-home visit characteristics using counts and frequencies, as well as medians (IQR). We compared characteristics across the three groups using chi-square and Kruskal-Wallis tests, at a p<0.05 significance threshold. All analyses were executed in SAS software, version 9.4 (SAS Institute Inc., Cary, NC).

Subgroup Analyses

We examined the subgroup of patients under age 18 at the time of their index home visit. For this group, we determined whether or not each patient had a history of a pediatric complex chronic medical condition, according to a definition used by the Canadian Institute for Health Information (CIHI).[41]

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RESULTS

Physician Home Visits over Time

The annual number of home visits per 10,000 people declined slightly in 2005-2007, remained stable from 2007-2012, and then increased from 2012-2018 to a maximum of 306 per 10,000 people in 2018 (Figure 1)— a 137% increase relative to 2005. Despite only accounting for 19.5% (N=859,978) of all physician home visits, palliative home visits per 10,000 people increased 11-fold and accounted for 90.5% of the growth in home visit volume from 2005 to 2018.

Homecare service recipients received 28.9% of physician home visits (N=1,278,391), and 51.6% (N=2,279,965) who were neither palliative nor homecare service recipients were classified as "other". Although the "other" group accounted for a 22.9% increase in physician home visit costs from 2005 to 2018, the relative stability of visits per 10,000 people over time suggests that much of this may have been accounted for by population growth.

 The total annual cost of physician home visits reached a peak of $56.3 million in 2018 (Figure 2)—40.2% of this was the cost of palliative home visits ($22.6 million), 20.4% of this was the cost of visits to homecare service recipients ($11.5 million)and 39.4% ($22.2 million) was the cost of home visits to "other" recipients.

Characteristics of Patients Receiving Home Visits

From 2014 to 2018, 413,057 patients received at least one physician home visit - 17.4% received two, and 31.8% received more than two over the following year. Among physician home visit recipients, 13.1% (n=53,997) were children, 28.6% (n=118,127) were adults under age 65, and 58.3% (n=240,933) were older adults (Table 1).

Recipients of physician home visits were more likely to be female (57.6%), and they mostly (78.3%) resided in large urban settings. More than half were high healthcare users (57.9%), and 20.4% and 15.4% had an emergency department visit and hospital discharge in the previous 30 days. Yet, most (63.3%) had not received any homecare services in the previous month. The majority (74.5%) were formally enrolled to a primary care physician; however, the home visiting physician was their own physician in only 28.9% of visits; another physician in the same group provided 3.5% of visits. The physician was previously known to the patient in just under half of physician home visits (45.8%).

Comparison between Physician Home Visit Types

Of all patients who received a first physician home visit, 17.2% (N=70,947) had a palliative visit, 20.7% (N=85,343) received homecare services and the remaining 62.2% (N=256,767) were classified as "other."

Compared to the palliative and homecare service recipients, other patients who received physician home visits were younger (36.5% under age 40, compared to 1.3% and 1.6%, p<0.001, Table 1) and had fewer comorbidities (Lowest comorbidity group 37.5% compared to 7.9% and

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12.6%, p<0.0001). This group also had the lowest rates of healthcare utilization over the previous 2 years (lowest utilization band 13.5% compared to 0.6% and 1.7%), including fewer outpatient visits in the previous year (median 8 compared to 31 and 16, p<0.001), and fewer patients with an emergency department visits (11.6% compared to 43.5% and 27.8%) or hospital discharge in the previous 30 days (6.2% compared to 39.1% and 23.5%).

Patients in the "other" group were more likely to live in a large urban area (83.7% compared to 65% and 73.0%, p<0.001), to be immigrants (11.7% vs 7.0% palliative and 7.2% homecare, p<0.001) and to have limited proficiency in English and French (4.5% vs 3.2% palliative, 3.5% homecare, p<0.001). Homecare service recipients and the "other" group were more likely to live in low-income neighborhoods (lowest quintile 25.1% and 24.2% compared to 21.2%, p< 0.001), however the "other" group and the palliative group included more patients from high-income neighborhoods (20.8% and 19.4% compared to 15.9%, p<0.001).

Homecare service recipients were most likely to receive a physician home visit from their own primary care physician or a physician in the same group (48.7% vs 28.6% palliative, 28.0% "other", p<0.001). Patients in the "other" group were least likely to have a home visit with a physician who was previously known to them (39.0% compared to 51.7% and 61.4%, p<0.001).

Palliative and homecare service recipients were more likely to receive subsequent physician home visits than those in the "other" group, who often (60.8%) had no subsequent visits (p<0.001). Patients in the "other" group had the lowest 30-day rate of visit to the emergency department (13.0 compared to 20.3 and 23.9, p <0.0001) and urgent hospitalization (4.5% compared to 14.7% and 13.8%, p <0.001).

The most common diagnoses in the "other" group were acute nasopharyngitis (14.2%), acute bronchitis (4.6%), anxiety and related conditions (4.3%), dementia (4.1%) and hypertension (2.9%); the rest of the top 10 conditions are listed in Appendix Table 4).

Subgroup: Long-Stay Homecare (RAI-HC) Assessment

In our patient cohort, 19.9% (N=82,375) of all physician home visit recipients had a long-stay homecare assessment (RAI-HC) completed in the previous 6 months—this was 27.0% of the palliative group, 61.3% of the homecare services group, and just 4.3% of the "other" group. Among these, homecare service recipients were most likely to have impairments in vision and hearing, use of an assistive device, and be dependent on others for locomotion. They were also most likely to be homebound or borderline homebound. About a third of "other" patients who had a RAI-HC assessment were homebound (31.5%), however this represented only 1.3% of all patients in the "other" group (compared to 9.4% of palliative group, 25.2% of homecare group).

Subgroup: Pediatric Patients

There were 53,997 patients under age 18, representing 13.1% of the cohort- this was 0.8% of the palliative group, 0.4% of the homecare services group, and 20.7% of the "other" group.

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Nearly all (98.3%) pediatric home visits were neither palliative nor delivered to homecare recipients, and classified as "other."

Those in the "other" group were considerably less likely to have a pediatric chronic medical condition (3.9% compared to 76.2% and 70.0%, p<0.001, Table 3), had lower rates of previous healthcare utilization (lowest utilization band 30.5% compared to 8.4% and 5.8%, P<0.001), including fewer emergency department visits (5.7% compared to 20.3% and 15.8%), hospitalizations (2.6% compared to 35.7% and 16.7%) and outpatient visits (median 5 compared to 31 and 14, p<0.001).

Patients in the other group were least likely to have a home visit with a physician who was previously known to them (15.0% compared to 49.9% and 31.5%, p<0.001). They were also least likely to have an emergency department visit (9.1% compared to 16.6% and 17.3%, p<0.001) or hospitalization within 30 days following the physician home visit (0.9% compared to 10.2% and 10.0%, p<0.001).

The most common diagnoses for this group were acute nasopharyngitis (32.6%), other viral diseases (6.0%), serous otitis media (5.2%), gastroenteritis (4.7%), and acute bronchitis (3.5%, Appendix Table 5).

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DISCUSSION

After a plateau from 2007 to 2012, the annual rate of physician home visits in Ontario increased to 306 per 10,000 people in 2018. Overall, 62% of patients who received their first physician home visit were neither palliative nor homecare service recipients. This group of patients was younger, with fewer comorbidities and lower rates of prior healthcare utilization than those receiving palliative home visits or homecare services. This group was also least likely to have repeat physician home visits, subsequent emergency department visits and hospitalizations. These findings suggest that physician home visit recipients who are neither palliative nor on a homecare services roster are an overall younger, healthier population that may access physician home visits for reasons other than a physical inability to leave the home.

In our study, patients in the "other" group were least likely to have previous encounters with the home visiting physician. Similar to walk-in clinic encounters[42] and U.S. home visits requested using a smartphone application[43], we found the most common diagnoses in the "other" group were acute viral illnesses. On-demand physician home visits come at the cost of relational and informational discontinuity with the usual primary care provider. Whether because of a lack of attachment to a primary care provider, insufficient after-hours access to their usual provider, or a desire for convenience, this trade-off may be acceptable to many patients.[43] In addition, the overrepresentation of both the lowest and highest income quintiles, and a greater proportion of immigrants in the "other" group could indicate that broad availability of physician home visits contributes to equity of access for groups with inflexible work hours or caregiving responsibilities. It is not known how such visits contribute to other dimensions of quality healthcare, such as efficiency and effectiveness.[44]

Since 2005 when palliative special visit premiums were introduced to Ontario,[21] the volume of palliative home visits has increased steadily, and these accounted for most of the growth in total home visit volume and costs from 2005-2018. This is good news, as many palliative patients have a high symptom burden, limited mobility outside the home, and high healthcare needs. The annual volume of physician home visits also had a notable inflection point in 2012, when volume bonuses for primary care home visits were substantially increased.[22] After 2012, both homecare service recipients and "other" home visits began a steady rise in annual volume. In contrast, physician home visits were recently declining in British Columbia, Canada[45] and Switzerland.[46] Notably, many European countries have much higher rates of home visit provision than in North America - whereas over 60% of primary care physicians surveyed in the UK, Netherlands and Switzerland reported commonly providing home visits, this was only 19% in Canada, and 6% in the U.S.[47] The U.S., like Ontario, has benefitted from financial incentives to support physician home visits. Home visits in the U.S. have risen dramatically over the past 20 years, as a result of increased fee-for-service payments through Medicare, special funding through demonstration projects, and healthcare reform prioritising high-value care.[16] Notably,

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hospitals and accountable care organizations have found home visits to be cost-saving, as a result of avoided readmissions, and fewer hospital and nursing home bed-days.[8,11,16]

Until 2019, Ontario's particular incentive structure did little to ensure that physician home visits were reserved for those who would otherwise have high healthcare use. In 2019, the physician fee schedule was changed to limit home visit premiums to "frail elderly or housebound" patients.[48] This change should reduce the number of "other" home visits, however the interpretation of any subsequent changes in home visit volumes will be confounded by the onset of the COVID-19 pandemic -- in spring 2020, physician home visits had dropped by 60% compared to the previous year.[49] It will be essential to examine how and whether physician home visits rebound, to evaluate the effect of the 2019 fee schedule change and to ensure that the needs of Ontario's growing homebound population are met.

Our study has several limitations. First, we could not capture home visits provided by salaried nurse practitioners who often work in team-based primary care models. As a result, our numbers for total physician home visits underestimate the total number of home visits by all primary care providers in Ontario. Second, we used receipt of homecare services as a proxy for functional dependency or homebound status, however we could not identify receipt of private homecare services, or support by unpaid caregivers. As a result, the "other" patient category will contain a small number of functionally dependent individuals. Third, in this study using health administrative data we could not ascertain why patients sought a home- rather than office-based visit. Finally, although our findings are rooted in an Ontario context, they are likely generalizable to settings with similar physician payment structures- that is, physician remuneration through fee-for-service and capitation-based models.

Conclusion

In this study of the population of Ontario, Canada, we found that physician home visits increased 137% from 2005-2018—most of this growth was explained by an 11-fold increase in palliative home visits. Yet, 52% of all physician home visits during this time were provided to patients who were neither palliative nor receiving homecare services. This group was younger, healthier, and had fewer previous and subsequent healthcare encounters than their comparators. Such home visits may facilitate access at the expense of continuity of care. Our findings will inform payment models and regulatory frameworks to support the provision of high-quality physician home visits to those who are most likely to benefit. Further research is needed on the efficiency and effectiveness of low-complexity home visits, and to monitor the recovery of necessary physician home visits in the wake of the COVID-19 pandemic.

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Figure 1. Annual physician home visits per 10,000 people by type, in Ontario 2005-2018.
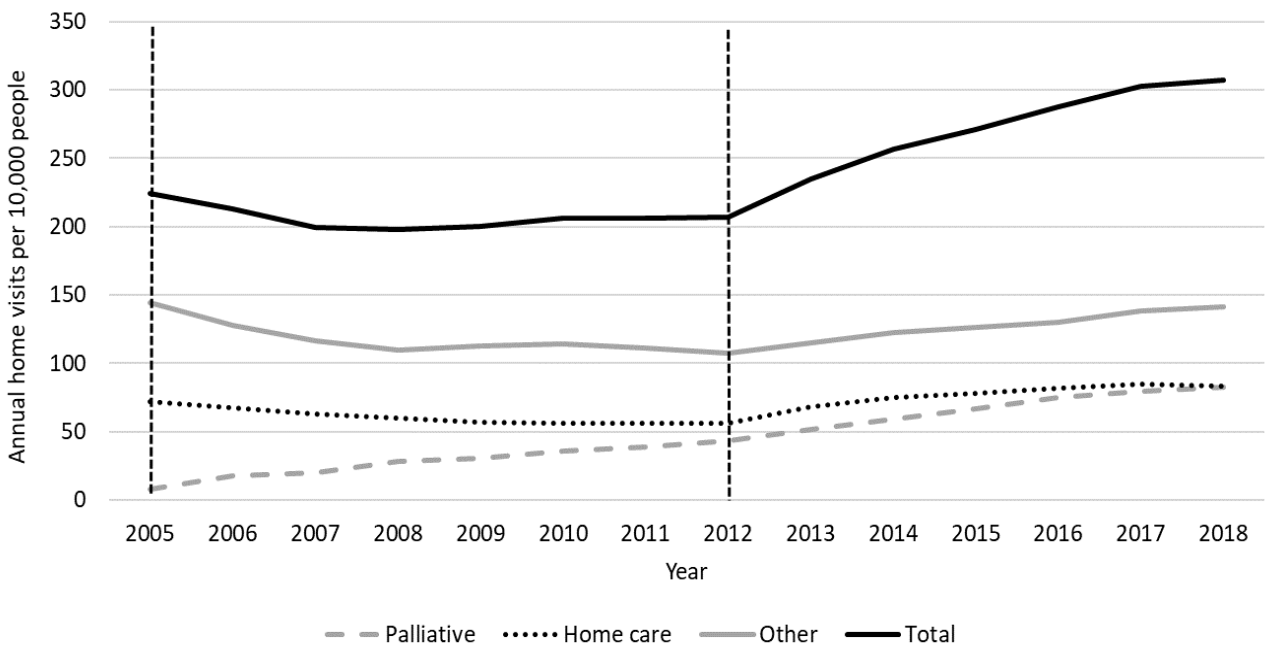
Lines at 2005 and 2012 mark the introductions of premium billing codes for palliative home visits, and higher volume incentives for primary care home visits, respectively.

Figure 2. Annual total physician billings for home visits by type, in Ontario 2005-2018
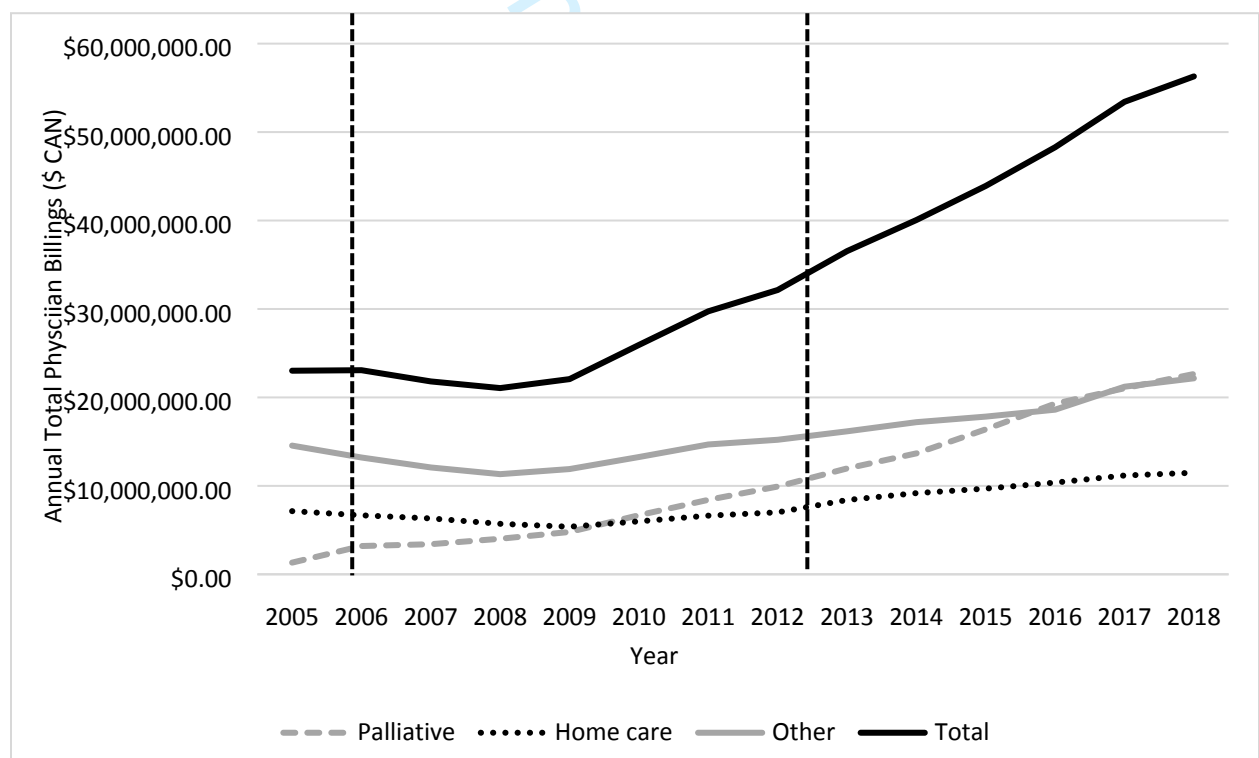
Lines at 2005 and 2012 mark the introductions of premium billing codes for palliative home visits, and higher volume incentives for primary care home visits, respectively.

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Table 1. Baseline, visiting physician and post-visit characteristics of patients receiving a physician home visit in Ontario, April 1st 2014 to March 1st, 2019. P-values for comparison between home visits types: palliative, homecare services recipient and other.

Characteristic	Palliative (N=70,947)	Homecare service recipient (N=85,343)	Other (256,767)	Total (N=413,057)	P-value
Baseline Characteristics					
Age, n (%)					
<18 years	597 (0.8)	330 (0.4)	53,070 (20.7)	53,997 (13.1)	<0.001
18 - 39 years	1,071 (1.5)	999 (1.2)	40,606 (15.8)	42,676 (10.3)	
40 - 64 years	15,264 (21.5)	7,278 (8.5)	52,909 (20.6)	75,451 (18.3)	
65 - 79 years	26,294 (37.1)	20,807 (24.4)	42,993 (16.7)	90,094 (21.8)	
80+ years	27,721 (39.1)	55,929 (65.5)	67,189 (26.2)	150,841 (36.5)	
Sex female, n (%)	36,061 (50.8)	53,181 (62.3)	148,845 (58.0)	238,087 (57.6)	<0.001
Residence setting, n (%)					
Large urban	46,104 (65.0)	62,335 (73.0)	214,844 (83.7)	323,283 (78.3)	<0.001
Small urban	18,779 (26.5)	16,003 (18.8)	27,331 (10.6)	62,113 (15.0)	
Rural	5,428 (7.7)	6,363 (7.5)	11,913 (4.6)	23,704 (5.7)	
Missing	636 (0.9)	642 (0.8)	2,679 (1.0)	3,957 (1.0)	
Comorbidity count, n (%)					
Low (0 - 5)	5,581 (7.9)	10,723 (12.6)	96,165 (37.5)	112,469 (27.2)	<0.001
Moderate (6 - 9)	21,535 (30.4)	25,253 (29.6)	93,750 (36.5)	140,538 (34.0)	
High (10+)	43,831 (61.8)	49,367 (57.8)	66,852 (26.0)	160,050 (38.7)	
Healthcare utilization band, n (%)					
Low (0 - 2)	405 (0.6)	1,426 (1.7)	35,102 (13.7)	36,933 (8.9)	<0.001
Moderate (3)	7,554 (10.6)	14,854 (17.4)	114,442 (44.6)	136,850 (33.1)	
High (4 - 5)	62,988 (88.8)	69,063 (80.9)	107,223 (41.8)	239,274 (57.9)	
Neighborhood income quintiles, n (%)					
1	15,043 (21.2)	21,423 (25.1)	62,125 (24.2)	98,591 (23.9)	<0.001
2	14,774 (20.8)	19,400 (22.7)	51,585 (20.1)	85,759 (20.8)	
3	14,113 (19.9)	16,552 (19.4)	45,364 (17.7)	76,029 (18.4)	
4	13,077 (18.4)	14,086 (16.5)	42,584 (16.6)	69,747 (16.9)	
5	13,756 (19.4)	13,537 (15.9)	53,527 (20.8)	80,820 (19.6)	
Missing	184 (0.3)	345 (0.4)	1,582 (0.6)	2,111 (0.5)	
Recent emergency department visit, n (%)	30,868 (43.5)	23,707 (27.8)	29,860 (11.6)	84,435 (20.4)	<0.001
Recent hospital discharge, n (%)	27,772 (39.1)	20,060 (23.5)	15,801 (6.2)	63,633 (15.4)	<0.001
Previous outpatient visits, median (IQR)	31 (17-51)	16 (8-27)	8 (4-16)	12 (5-24)	<0.001
Homecare service visits in previous month, n (%)					
0	12,129 (17.1)	0 (0.0)	249,336 (97.1)	261,465 (63.3)	<0.001
1	4,106 (5.8)	0 (0.0)	7,431 (2.9)	11,537 (2.8)	
2+	54,712 (77.1)	85,343 (100.0)	0 (0.0)	140,055 (33.9)	
Dementia, n (%)	9,856 (13.9)	31,132 (36.5)	27,891 (10.9)	68,879 (16.7)	<0.001
Mental health visits, n (%)	2,620 (3.7)	5,714 (6.7)	10,814 (4.2)	19,148 (4.6)	<0.001
Chronic obstructive pulmonary disease (COPD), n (%)	25,071 (35.3)	29,877 (35.0)	39,774 (15.5)	94,722 (22.9)	<0.001
Congestive heart failure, n (%)	15,246 (21.5)	26,922 (31.5)	23,013 (9.0)	65,181 (15.8)	<0.001
Asthma, n (%)	11,029 (15.5)	16,203 (19.0)	48,016 (18.7)	75,248 (18.2)	<0.001
Post-partum or post-birth, n (%)	97 (0.1)	22 (0.0)	3,706 (1.4)	3,825 (0.9)	<0.001
Diabetes mellitus, n (%)	22,667 (31.9)	33,475 (39.2)	47,807 (18.6)	103,949 (25.2)	<0.001
Limited proficiency in English/French, n (%)	2,298 (3.2)	2,949 (3.5)	11,441 (4.5)	16,688 (4.0)	<0.001
Immigrant status, n (%)	4,998 (7.0)	6,126 (7.2)	29,975 (11.7)	41,099 (9.9)	<0.001
Primary care attachment, n (%)					
Formally enrolled	57,147 (80.5)	69,568 (81.5)	180,922 (70.5)	307,637 (74.5)	<0.001
Other primary care	11,891 (16.8)	14,443 (16.9)	66,165 (25.8)	92,499 (22.4)	
No primary care	1,909 (2.7)	1,332 (1.6)	9,680 (3.8)	12,921 (3.1)	

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Visiting Physician Characteristics					
Same as enrolled primary care physician, n (%)	16,084 (22.7)	38,532 (45.1)	64,814 (25.2)	119,430 (28.9)	<0.001
Another physician in same group as enrolled primary care physician, n (%)	4,195 (5.9)	3,015 (3.5)	7,190 (2.8)	14,400 (3.5)	<0.001
Either same as enrolled primary care physician or same group, n (%)	20,279 (28.6)	41,547 (48.7)	72,004 (28.0)	133,830 (32.4)	<0.001
Known to patient from a visit in the previous year, n (%)	36,683 (51.7)	52,372 (61.4)	100,067 (39.0)	189,122 (45.8)	<0.001
Post-Visit Characteristics					
Repeat home visits in subsequent year, median (IQR)	2 (0-5)	1 (0-3)	0 (0-1)	0 (0-2)	<0.001
Repeat home visits in subsequent year, n (%) 0 1 2 3+	 18,668 (26.3) 12,707 (17.9) 8,671 (12.2) 30,901 (43.6)	 35,101 (41.1) 15,753 (18.5) 9,116 (10.7) 25,373 (29.7)	 155,987 (60.8) 43,503 (16.9) 19,356 (7.5) 37,921 (14.8)	 209,756 (50.8) 71,963 (17.4) 37,143 (9.0) 94,195 (22.8)	 <0.001
Repeat home visits with same MD in subsequent year, n (%) 0 1 2 3+	 24,987 (35.2) 13,515 (19.0) 8,265 (11.6) 24,180 (34.1)	 46,160 (54.1) 13,816 (16.2) 7,035 (8.2) 18,332 (21.5)	 184,652 (71.9) 31,751 (12.4) 12,741 (5.0) 27,623 (10.8)	 255,799 (61.9) 59,082 (14.3) 28,041 (6.8) 70,135 (17.0)	 >0.001
Outpatient visit within 30 days, n (%)	32,127 (45.3)	34,774 (40.7)	109,366 (42.6)	176,267 (42.7)	<0.001
Emergency department visit within 30 days, n (%)	14,422 (20.3)	20,388 (23.9)	33,491 (13.0)	68,301 (16.5)	<0.001
Urgent hospitalization within 30 days, n (%)	10,404 (14.7)	11,763 (13.8)	11,511 (4.5)	33,678 (8.2)	<0.001

Table 2. Clinical Characteristics within Subgroup with a Recent Homecare Assessment

	Palliative (N=19,137)	Homecare service recipients (N=52,273)	Other (N=10,965)	Total (N=82,375)	P-value
Hearing impaired, n (%)	3,491 (18.2)	11,656 (22.3)	2,013 (18.4)	17,160 (20.8)	<0.001
Vision impaired, n (%)	2,014 (10.5)	7,083 (13.6)	1,006 (9.2)	10,103 (12.3)	<0.001
Caregiver in home, n (%)	12,987 (67.9)	27,362 (52.3)	4,575 (41.7)	44,924 (54.5)	<0.001
Assistive device, n (%)	14,890 (77.8)	46,922 (89.8)	8,024 (73.2)	69,836 (84.8)	<0.001
Locomotion dependent on others, n (%)	10,594 (55.4)	31,278 (59.8)	4,155 (37.9)	46,027 (55.9)	<0.001
Homebound status, n (%) Homebound Borderline homebound	 6,635 (37.1) 5,927 (33.1)	 21,491 (43.0) 17,043 (34.1)	 3,259 (31.5) 3,238 (31.3)	 31,385 (40.1) 26,208 (33.5)	 <0.001

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Table 3. Baseline, visiting physician and post-visit characteristics of patients under age 18 receiving a physician home visit in Ontario, April 1st 2014 to March 1st 2019.* P-values for comparison between home visits types: palliative, homecare services recipient and other.

Characteristic	Palliative (N=597)	Homecare recipient (N=330)	Other (N=53,070)	Total (N=53,997)	P-value
Baseline Characteristics					
Age, median (IQR)	6.44 ± 5.69	7.85 ± 6.08	5.48 ± 5.06	5.50 ± 5.08	<0.001
Age group					<0.001
0 – 1	183 (30.7)	88 (26.7)	15,697 (29.6)	15,968 (29.6)	
2 – 5	116 (19.4)	55 (16.7)	16,261 (30.6)	16,432 (30.4)	
6 - 12	172 (28.8)	83 (25.2)	13,907 (26.2)	14,162 (26.2)	
13+	126 (21.1)	104 (31.5)	7,205 (13.6)	7,435 (13.8)	
Sex female, n (%)	268 (44.9)	136 (41.2)	25,265 (47.6)	25,669 (47.5)	0.029
Residence setting, n (%)					<0.001
Large urban	390 (65.3)	275 (83.3)	50,215 (94.6)	50,880 (94.2)	
Small urban	145 (24.3)	32 (9.7)	2,055 (3.9)	2,232 (4.1)	
Rural	45 (7.5)	14 (4.2)	525 (1.0)	584 (1.1)	
Missing	17 (2.8)	9 (2.7)	275 (0.5)	301 (0.6)	
Any complex chronic medical condition, n (%)	455 (76.2)	231 (70.0)	2,050 (3.9)	2,736 (5.1)	<0.001
Neighborhood income quintiles, n (%)⬚					<0.001
1	108 (18.1)	82 (24.8)	12,568 (23.7)	12,758 (23.6)	
2	104 (17.4)	67 (20.3)	9,190 (17.3)	9,361 (17.3)	
3	119 (19.9)	62 (18.8)	8,948 (16.9)	9,129 (16.9)	
4	136 (22.8)	60 (18.2)	9,381 (17.7)	9,577 (17.7)	
5	123 (20.6)	54 (16.4)	12,788 (24.1)	12,965 (24.0)	
Recent emergency department visit, n (%)	121 (20.3)	52 (15.8)	2,890 (5.4)	3,063 (5.7)	<0.001
Recent hospital discharge, n (%)	213 (35.7)	55 (16.7)	1,380 (2.6)	1,648 (3.1)	<0.001
Previous outpatient visits, median (IQR)	31 (12-64)	14 (8-28)	5 (3-9)	5 (3-10)	<0.001
Homecare service visits in previous month, n (%)					<0.001
0	284 (47.6)	0 (0.0)	52,963 (99.8)	53,247 (98.6)	
1	54 (9.0)	0 (0.0)	107 (0.2)	161 (0.3)	
2+	259 (43.4)	330 (100.0)	0 (0.0)	589 (1.1)	
Post-partum or post birth, n (%)	85 (14.2)	**	2,243 (4.2)	2,328 (4.3)	<0.001
Mental health visits, n (%)	13 (1.4)**		591 (1.1)	604 (1.1)	0.65
Asthma, n (%)	133 (22.3)	98 (29.7)	9,383 (17.7)	9,614 (17.8)	<0.001
Limited proficiency in English/French, n (%)	11 (1.2)**		918 (1.7)	929 (1.7)	0.037
Immigrant status, n (%)	11 (1.8)	11 (3.3)	1,307 (2.5)	1,329 (2.5)	0.368
Primary care attachment, n (%)					<0.001
Formally enrolled	259 (43.4)	125 (37.9)	23,051 (43.4)	23,435 (43.4)	
Other primary care	195 (32.7)	159 (48.2)	25,176 (47.4)	25,530 (47.3)	
No primary care	143 (24.0)	46 (13.9)	4,843 (9.1)	5,032 (9.3)	
Visiting Physician Characteristics					
Same as enrolling primary care physician, n (%)	39 (6.5)	42 (12.7)	3,181 (6.0)	3,262 (6.0)	<0.001
Either same enrolling primary care physician or same group, n (%)	60 (10.1)	46 (13.9)	3,927 (7.4)	4,033 (7.5)	
Known to patient from a visit in the previous year, n (%)	298 (49.9)	104 (31.5)	7,949 (15.0)	8,351 (15.5)	<0.001

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Post-Visit Characteristics					
Repeat home visits in subsequent year, median (IQR)	2 (0-7)	0 (0-2)	0 (0-1)	0 (0-1)	<0.001
Repeat home visits in subsequent year, n (%) 0 1 2 3+	 197 (33.0) 75 (12.6) 56 (9.4) 269 (45.1)	 180 (54.5) 62 (18.8) 34 (10.3) 54 (16.4)	 33,946 (64.0) 10,103 (19.0) 4,168 (7.9) 4,853 (9.1)	 34,323 (63.6) 10,240 (19.0) 4,258 (7.9) 5,176 (9.6)	<0.001
Repeat home visits with same MD in subsequent year, n (%) 0 1 2 3+	 270 (45.2) 91 (15.2) 64 (10.7) 172 (28.8)	 245 (74.2) 46 (13.9) 14 (4.2) 25 (7.6)	 44,294 (83.5) 5,716 (10.8) 1,577 (3.0) 1,483 (2.8)	 44,809 (83.0) 5,853 (10.8) 1,655 (3.1) 1,680 (3.1)	<0.001
Outpatient visit within 30 days, n (%)	339 (56.8)	159 (48.2)	19,941 (37.6)	20,439 (37.9)	<0.001
Emergency department visit within 30 days, n (%)	99 (16.6)	57 (17.3)	4,815 (9.1)	4,971 (9.2)	<0.001
Urgent hospitalization within 30 days, n (%)	61 (10.2)	33 (10.0)	494 (0.9)	588 (1.1)	<0.001

* Dementia, COPD, CHF and post-partum status were not reported in this group.

** cells suppressed to prevent re-identification of groups <6 individuals

⯑ N=207 with missing values

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APPENDIX

Appendix Table 1- ICES data sources

Database name	Description
Registered Persons Database (RPDB)	Contains demographic information about anyone who has ever received an Ontario health card number, i.e. all Ontarians alive at any time since 1990 (over 16 million records).(1)
Ontario Health Insurance Plan (OHIP)	Contains information on all billing claims submitted by Ontario physicians (consultations and procedures). Fee for service is the primary method of remuneration for 95% of specialist physicians and 50% of primary care physicians in Ontario. However, physicians practicing in non fee-for-service models submit shadow billings to OHIP, which appear as billing claims with a payment value of $0.(2)
National Ambulatory Care Reporting System (NACRS)	Includes information for all emergency department visits since 2000. A re-abstraction study of diagnostic codes found 85% agreement for the main presenting problem.(3)
Discharge Abstract Database (DAD)	Information on all admissions (excluding designated mental health beds) to acute care hospitals in Ontario. This includes dates of admission as well as diagnostic and procedural codes. Overall, diagnostic codes were found to be 82% sensitive for primary diagnosis when verified against chart abstraction.(4)
Ontario Mental Health Reporting System (OMHRS)	Includes information on all admissions to designated adult inpatient mental health beds in Ontario.(5)
Home Care Database (HCD)	Includes all publicly funded home care services, including the service type (end-of-life or not).(6)
Client Agency Program Enrolment Database (CAPE)	Links physicians to their enrolled patients under several patient enrolment models of clinical practice. These funding models include enhanced fee for service, non-team capitation, and team-based capitation.(7)
Immigration Refugees and Citizenship Canada Permanent Resident Database (IRCC)	Contains information on immigrants who have landed in Ontario since 1985.(8)
Ontario Diabetes Dataset (ODD)	Contains individuals in Ontario with any type of non-gestational diabetes identified since 1991. Combines data from OHIP, RPDB, ODB and DAD. When validated against clinical charts, this was 90% sensitive and 98% specific for a diagnosis of adult diabetes.(9)
Ontario Congestive Heart Failure (CHF) dataset	Contains all Ontario individuals with CHF identified since 1991. This dataset combines data from DAD, OMHRS, OHIP and NACRS. Among adults over age 40, sensitivity was 85% and specificity was 97% when validated against chart review.(10)
Ontario Chronic Obstructive Pulmonary Disease Cohort (COPD)	Contains all Ontario COPD patients identified since 1991. This dataset combines data from DAD and OHIP. Among adults over age 35, sensitivity was 85% and specificity was 78% when validated against chart review.(11)

Ontario Dementia dataset (DEMENTIA)	Includes all Ontario persons who were identified with Alzheimer's and related dementias in ICES data holdings between the ages of 40 to 110 years. This dataset combines data from DAD, OHIP and prescribed medications from the Ontario Drug Benefit (ODB). Among adults over age 65, sensitivity was 79% and specificity was 99% when validated against chart review.(12)
Ontario Asthma Cohort (ASTHMA)	Contains all Ontario asthma patients identified since 1991. Combines information from DAD and OHIP. In adults, 80% sensitive, 81% specific against chart review.(13) Among those under age 18, 89% sensitive, 72% specific against chart review. (14)
MOMBABY dataset	MOMBABY dataset links the DAD inpatient admission records of delivering mothers and their newborns.(15)

Appendix Table 2- Codes Used to Identify Palliative Care and Not Palliative Home Visits. Home visits were first classified as palliative if any palliative codes were present.

Type of Home Visit	Code	Descriptor of code
Palliative care	B998	Palliative Home Visit- Special visit premium daytime/evenings/weekend
	B997	Palliative Home Visit- Special visit premium nights
	B966	Palliative Home Visit- Travel premium
	A945	GEN./FAM.PRACT.SPECIAL PALLIATIVE CARE CONSULTATION
	A905	GENERAL/FAMILY PRACTICE-LIMITED CONSULTATION
	G512	Palliative care case management fee
	K700	PALLIATIVE CARE OUT-PATIENT CASE CONFERENCE
Not palliative (used for home care services group and "other" group)	A901	House call assessment (in FP/GP section)
	A900	Complex house call assessment- for "frail elderly or housebound"
	A902	House call-to pronounce death
	B960, B990, B961, B992	Home visit Special visit premiums daytime
	B962, B994, B964, B996	Home visit Special visit premiums evenings and nights
	B963, B993	Home visit Special visit premiums Weekends and holidays

Appendix Table 3- Operational Definitions for all Variables

Variable	Data Source	Definition
Age	RPDB	Categorized as <18 years (children) 18-39 years (young adult) 40-64 years (middle aged) 65-79 years (younger seniors) 80+ years (older seniors)
Sex	RPDB	Male Female
Residence setting	RPDB	Postal code converted to RIO score(16) 0-9 : large urban 10-39: small urban 40+: rural
Neighborhood income quintile	RPDB, Census	Nearest census-based income quintile based on postal code (based on 2016 census).(17)
Comorbidity count	DAD, NACRS, OHIP	Count of ACG System Aggregated Diagnosis Groups (ADGs, per the Johns Hopkins ACG® System Version 7, in 2 years prior to the index date.(18) Categorized as: Low 0-5 Moderate 6-9 High 10+
Healthcare Utilization	DAD, NACRS, OHIP	Using Resource Utilization Bands (RUBs), per the Johns Hopkins ACG® System Version 7, in 2 years prior to the index date.(18) Categorized as: Low (0-2) Moderate (3) High (4-5)
Pediatric Chronic Medical Condition (Pediatric subgroup only)	DAD	For pediatric (under age 18 group), diagnostic code of a chronic medical condition or any procedure either inpatient or outpatient, per the definition use by the Canadian Institute for Health Information.(19)
Recent emergency department visit	DAD	At least one emergency department in the previous 30 days.
Recent hospital discharge	DAD	Discharged from an acute care facility within the previous 30-day period.
Previous outpatient physician visits	OHIP	Count of all visits in previous year that occurred in an office setting (location="O"). Exclude codes that start with: X, J, L, E, Q0**, Q1**, Q2**. Combine all codes by same physician, on same day, with same patient into 1, to avoid double counting office visits.
Homecare service visits in previous month	HCD	Number of home care visits in the 30 days before the home visit (restrict to only visits with CARESITE=21 (household).

Dementia		Code as 1 if either of: - presence in "DEMENTIA" dataset at ICES. - RAI-HC component (J1G or J1H)=yes in 5-year look-back from index date.
Mental health visits	OHIP/NACRS/DAD/OMHRS	Coded as 1 if any admission, emergency department visits, or outpatient visit for a mental health-related condition in previous 2 years. The detailed algorithm and codes used have been described elsewhere: - ED/admissions using NACRS, DAD and OMHRS data(20) - outpatient visits using OHIP data(21)
Chronic obstructive pulmonary disease (COPD)	COPD	Presence in COPD database
Congestive heart failure (CHF)	CHF	Presence in CHF database
Asthma	ASTHMA	Presence in ASTHMA database
Post-partum	MOMBABY	Presence in "MOM-BABY" dataset with baby date of birth up to 90 days before index home visit date. (B_BDATE-index date ≤ 90 days) If yes then code as 1. Otherwise code as 0.
Diabetes	ODD	Presence in ODD
Limited proficiency in English or French	IRCC	CAN_LANG=4 in IRCC database
Immigrant status	IRCC	Present in IRCC database(8)
Primary care attachment	CAPE, OHIP	%getpcprovider macro using the methods described by Stukel et al.(22) - formally enrolled(ROSTERED=1) - other primary care physician (ROSTERED=2) - no primary care (ROSTERED=0)
Same as enrolled primary care provider	CAPE	%getpcprovider macro using the methods described by Stukel et al.(22) Code as yes if the home visit MD is the same MD as enrolled MD ('ROSTERED'=1)
Another physician in same group as enrolled primary care provider	CAPE	Use macro %getpcprovider If "ROSTERED"=1 then Compare patient's enrolling "groupnum" to groupnum(s) of home visit physician on index date. If patient rostered=1 and physnums are different, but groupnums are the same, then code as 1.
Either same as enrolled primary care provider or same group	CAPE	Use macro %getpcprovider If "ROSTERED"=1 then Compare patient's enrolling "groupnum" to groupnum(s) of home visit physician on index date. If patient rostered=1 and groupnum is the same code as 1
Known to patient from a visit in the previous year	OHIP	Home visit MD had least 1 previous visit (in any setting) with this patient in the previous 365 days

Repeat home visits in subsequent year	HCD	Count of repeat home visits (combined multiple home visits in one day into one home visit) in subsequent 365 days after the first.
Repeat home visits with same MD in subsequent year	OHIP	Subsequent MD home visits with the same physician as the first home visit.
Outpatient visit within 30 days	OHIP	Count of outpatient physician visit in the **30 days** following the home visit- include the day of the home visit. Code as outpatient visit if there is at least one visit that is assigned to location = "O" (office), excluding OHIP codes starting with: X, J, L, E, Q0**, Q1**, Q2**
Emergency department visit within 30 days	NACRS	Code as 1 if visit to the emergency department within 30 days of home visit. Start count on the day of the index home visit date
Urgent hospitalization within 30 days	DAD	Code as 1 if urgent admission (ADMCAT="U") to an acute care hospital within 30 days of home visit. Start the count on the day of the index home visit date.
Subgroup with RAI-HC completed within 6 months prior to index physician home visit		
Hearing impaired	RAI-HC	C1_RAIHC=(2 or 3) or D3=(2, 3, or 4) Corresponds to "Hearing" is either "hears in special situations only" or "highly impaired"
Vision impaired	RAI-HC	D1_RAIHC or D4=(2, 3, or 4) Corresponds to "Vision" is "impaired" (sees large print only) or "moderately impaired" or "highly impaired" or "severely impaired"
Caregiver in home	RAI-HC	Score as 1 if either (G1EA_RAIHC or G1EB_RAIHC)=0 (in form 0=yes) Corresponds to "Informal helpers (primary and secondary)" and "lives with client" for each of "primary" and "secondary."
Assistive Device	RAI-HC	Coded as 1 if (H4A or H4B) = (1,2,3,4) Corresponds to "Primary modes of locomotion" any of: "cane", "walker/crutch", "scooter", or "wheelchair"
Dependent on others for locomotion	RAI-HC	Not independent, if (G2f or H2C)=(1,2,3,4,5,6,8) Corresponds to "Locomotion in home" within "ADL self-performance" anything other than "independent" (includes "setup help only", "supervision", limited assistance", "extensive assistance", "maximal assistance", "total dependence" and "activity did not occur").
Homebound Status	RAI-HC	Not homebound (0)= H6A ("Stamina-Days") is 0-1 Borderline homebound (1)= H6A ("Stamina-Days") is 2 Homebound (2)= H6A ("Stamina-Days") is 3 **or** G4b=0

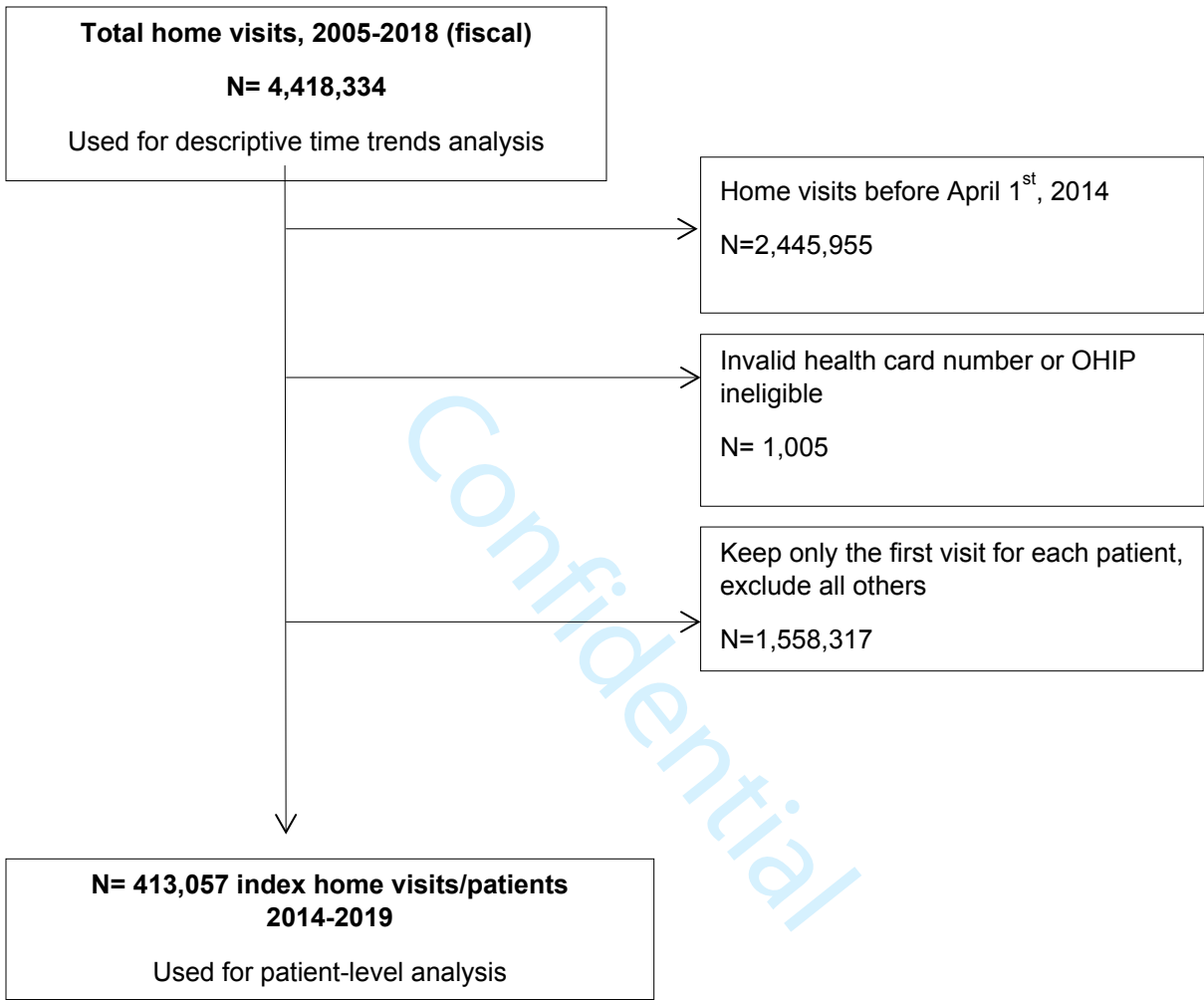**Appendix Table 4: Top 10 Most Common Diagnoses Claimed for Home Visits to Patients in the "Other" group**

Diagnosis code	Description	N (%)
460	Acute nasopharyngitis, common cold	36,411 (14.2)
466	Acute bronchitis	11,841 (4.61)
300	Anxiety neurosis, hysteria, neurasthenia, obsessive compulsive neurosis, reactive depression	10,951 (4.26)
290	Senile dementia, presenile dementia	10,404 (4.05)
401	Essential, benign hypertension	7,449 (2.90)
787	Anorexia, nausea and vomiting, heartburn, dysphagia, hiccough, hematemesis, jaundice, ascites, abdominal pain, melena, masses	7,424 (2.89)
009	Diarrhea, gastro-enteritis, viral gastro-enteritis	7,136 (2.78)
799	Other ill-defined conditions	6,427 (2.50)
781	Leg cramps, leg pain, muscle pain, joint pain, arthralgia, joint swelling, masses	6,382 (2.48)
079	Other viral diseases	6,229 (2.42)

Appendix Table 5: Top 10 Most Common Diagnoses Claimed for Home Visits to Patients Under Age 18 in the "Other" group

Diagnosis code	Description	N (%)
460	Acute nasopharyngitis, common cold	17,333 (32.6)
079	Other viral diseases	3,186 (6.00)
381	Serous otitis media, eustachian tube disorders	2,753 (5.19)
009	Diarrhea, gastro-enteritis, viral gastro-enteritis	2,488 (4.69)
466	Acute bronchitis	1,865 (3.51)
382	Suppurative otitis media	1,651 (3.11)
691	Eczema, atopic dermatitis, neurodermatitis	1,623 (3.06)
034	Streptococcal sore throat, scarlet fever	1,605 (3.02)
787	Anorexia, nausea and vomiting, heartburn, dysphagia, hiccough, hematemesis, jaundice, ascites, abdominal pain, melena, masses	1,602 (3.02)
463	Acute tonsillitis	1,233 (2.32)

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Appendix Figure 1- Flowchart

| Total home visits, 2005-2018 (fiscal) |
| **N= 4,418,334** |
| Used for descriptive time trends analysis |

Home visits before April 1st, 2014

N=2,445,955

Invalid health card number or OHIP ineligible

N= 1,005

Keep only the first visit for each patient, exclude all others

N=1,558,317

| **N= 413,057 index home visits/patients 2014-2019** |
| Used for patient-level analysis |

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