Virtual Care Use Before and During the COVID-19 Pandemic: An Observational Study

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ABSTRACT

Background: There has been longstanding interest in virtual care, but until recently adoption had been modest. Anecdotal reports and small studies lacking generalizability have suggested that the COVID-19 pandemic produced a dramatic increase in utilization of virtual care as a substitute for in-person visits, but large population-based studies are largely lacking.

Methods: We used administrative data to evaluate changes in in-person and virtual care visits among all residents of Ontario, Canada (population 14.6 million) pre-COVID (2012-2019) and post-COVID (January-June, 2020). Virtual care increased from 1.8% of total ambulatory visits in Q4 of 2019, to 71% in Q2 of 2020. The proportion of physicians providing 1-or-more virtual visits per year increased from 7.7% in Q4 2019 to 86% in Q2 of 2020.

Interpretation: Utilization of virtual care increased to a similar degree in all patient subgroups including vulnerable populations defined as rural, older and from lower income neighborhoods. Our findings show that Ontario's approach to virtual care allowed broad adoption during the pandemic for all residents including populations typically considered disadvantaged with respect to technology.

INTRODUCTION

Virtual Care, commonly defined as medical care delivered at a distance using technology, has existed since the 1970s.[1] Despite significant interest and investment in virtual care, widespread adoption has been modest[2,3] because, among other things, payers have been slow to reimburse providers for telemedicine visits. Absent a reimbursement model that supported telemedicine, adoption lagged. As the COVID-19 pandemic evolved, payers around the globe have acted with unprecedented speed by altering fee schedules to encourage virtual visits and reduce the risk of viral transmission. In Ontario, the Ontario Health Insurance Plan (OHIP), quickly approved new temporary billing codes during the first wave of the pandemic, that allowed any type of technology, including phone calls, to be used for virtual care. These temporary billing codes, as well as the pre-existing video visit codes, are reimbursed the same amount as in-person visits.

It has been widely reported that virtual care adoption accelerated during the COVID-19 pandemic, but published data are limited. Previous studies have largely been limited to non-generalizable patient sub-groups.[4,5] Similarly, there has been widespread concern that virtual care may not be accessible to older adults or lower income patients, but empirical data to support this assertion are largely lacking.

We sought to quantify the uptake and use of virtual care for the full population of Ontario, Canada (population 14.6 million) before and during the COVID-19 pandemic and examine uptake amongst circumscribed vulnerable populations. We hypothesize that virtual care utilization increased substantially during the pandemic and that utilization would be lower for older patients and those from lower income neighbourhoods.

METHODS

Study Design and Data Sources

We conducted a population-based, cross-sectional study of all ambulatory patient visits in Ontario, Canada beginning long before the COVID pandemic (January 1, 2012) extending to June 30, 2020 using the following databases: (1) Ontario Health Insurance Plan (OHIP), which records all health services delivered by physicians to Ontario patients who are eligible for coverage; and (2) Registered Persons Database (RPDB), which contains demographic information of all patients covered under OHIP. The Postal Code Conversion File (PCCF) was used to convert all patient postal codes to neighborhood income quintiles. To determine chronic disease patient subgroups, we used the Discharge Abstract Database (DAD), which records all inpatient hospital admissions, the National Ambulatory Care Reporting System (NACRS), which contains data on all hospital- and community-based ambulatory care (including emergency department visits), and various ICES validated disease-specific registries. ICES is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement. Databases were linked using unique encoded identifiers and analyzed at ICES. Use of these databases for the purposes of this study was authorized under §45 of Ontario's Personal Health Information Protection Act, which does not require review by a research ethics board.

Population

We identified all ambulatory: 1) in-person visits; and 2) telemedicine visits using relevant physician billing codes. We excluded claims for any patient who was a non-Ontario resident and/or had an invalid or missing health card number. Prior to March 14, 2020, OHIP exclusively reimbursed for video telemedicine visit; in response to COVID, new billing codes were introduced on March 14, 2020 that liberalized reimbursement to include phone calls, Skype and Facetime (Supplemental Table 1).

We further identified patients diagnosed with ambulatory sensitive conditions including COPD, heart failure, asthma, hypertension, and diabetes using existing established ICES registries and algorithms.[6] Patients with serious mental illness were identified by at least two outpatient or one inpatient claims with the corresponding ICD-9 or 10 code for schizophrenia and psychotic disorders or bipolar disorder in the past 12 months. Angina patients were identified by at least one ED visit with the relevant ICD-9 or 10 code in the past 12 months (Supplemental Table 2).

Statistical Analysis

For each quarter of our study period (January 1, 2012- June, 30, 2020) we examined: 1) the number of in-person and virtual visits; 2) the proportion of ambulatory visits that were virtual (versus in-person); 3) the proportion of Ontario residents eligible for healthcare services who received at least one virtual visit; and 4) the proportion of providers who billed for at least one virtual visit. Chi-square tests were conducted to assess the distribution of various characteristics of patients who have used telemedicine (age category, sex, region of residence, neighborhood income quintile, and rurality) across the years 2012, 2016, and 2020. Each patient was stratified into residing in a rural or urban environment based upon postal code of residence using the

Rurality Index for Ontario (RIO) score. The RIO score was developed by the Ministry of Health and Long-Term Care as a method to fairly and consistently measure a community's degree of rurality based on its postal code.[7] We compared monthly or quarterly telemedicine utilization across age groups (visits per 1000 people), neighborhood income quintiles (visits per 1000 people), and chronic disease subgroups (visits per 100 people). The monthly or quarterly percentage growth from before to during the COVID-19 pandemic was calculated for the period February to June 2020 or 2019-Q3 to 2020-Q2 and compared using Kruskal Wallis tests. All analyses were performed in SAS 9.4 (SAS Institute).

RESULTS

Uptake of virtual care by patients and providers

Figure 1 shows longitudinal changes in in-person and virtual visits from January 1, 2012- June 30, 2020 (1A and 1B). During the pre-pandemic period, virtual care use increased slowly from 0.2% of total ambulatory visits in Q1 of 2012 to 1.8% of total ambulatory visits in Q4 of 2019. With the onset of the pandemic in 2020, virtual visit volumes rapidly increased, reaching 70% of ambulatory visit volumes during Q2 of 2020 (Figure 1B). When broken down by physician group, 74% of all primary care visits, and 64% of specialty care visits were delivered virtually.

Figure 1C shows that the percentage of Ontario residents who had one or more virtual visits per quarter increased gradually from 0.2% in 2012 to 1.3% in 2019, but then increased rapidly to 29% in Q2 of 2020. **Figure 1D** demonstrates the gradual uptake of virtual care by providers during the pre-COVID period, but then shows a rapid increase to 86% of providers who

delivered virtual care in Q2 of 2020. Video visit use increased by 40% between 2019 and 2020, however overall video visit use was only 8.8% of all virtual visits during the pandemic. The majority of virtual visits, 91.2%, were telephone visits that were billed using the new temporary billing codes.

Characteristics of patients who had virtual care

Table 1 shows the demographic characteristics of patients who had at least one virtual care visit in the calendar year 2012, 2016 or 2020. Compared to patients who used virtual care during the pre-pandemic period (2012 and 2016), the percentage of older adults using virtual care increased substantially (18.1% vs. 27.3%, $p<0.001$), as did the percentage of women (49.4% vs. 56.6%, $p<0.001$). While the absolute number of virtual visits increased during the pandemic for patients in both rural and urban areas, the proportion of rural patients using virtual care compared to rest of the province dropped (28.5% vs. 5.9%, $p<0.001$).

Figure 2 shows the rate of virtual care use by age (number of virtual visits per 1000 eligible patients per quarter). Of interest, telemedicine use increased with increasing age suggesting that older adults increased their use of virtual visits along with younger adults. **Figure 3** demonstrates that the rise in virtual care use from the pre-pandemic period to during the pandemic was both clinically and statistically similar across neighborhood income quintiles, suggesting that residents of lower income neighborhoods were not significantly disadvantaged. **Appendix 1** shows the distribution of the number of virtual visits in 2012, 2016 and 2020. The large majority of patients (93.3%) had between 1-5 virtual per year at all three time periods; however, there was

a significant increase in the number of patients with >5 virtual visits in 2020 as compared with the earlier periods.

Use of virtual care amongst patients with chronic diseases

Figure 4 shows the rate of virtual care use among patients with ambulatory care sensitive conditions and mental illness. The rates of virtual care use increased similarly across all conditions. In Q2 of 2020 patients with mental health conditions had the highest rate of virtual care use (184 visits/100 patients per quarter), followed by heart failure (158 visits/100 patients), COPD (152 visits/100 patients), angina (145 visits/100 patients), diabetes (130 visits/100 patients), hypertension (115 visits/100 patients) and asthma (88 visits/100 patients).

INTERPRETATION

In this population-based study in Ontario, we found a dramatic increase in virtual visits coinciding with the COVID-19 pandemic. Surprisingly, and in contrast to expectations, we observed similar growth in uptake of virtual care among both younger and older patients and among patients residing in wealthier and poorer neighborhoods. While there was a modest increase in video visits, the large majority of virtual care was delivered through phone calls, enabled by new billing codes introduced during the pandemic. Prior to the pandemic only a small proportion of physicians were providing virtual care. With the arrival of COVID a large majority of Ontario physicians are now providing virtual care and the majority of Ontario residents received at least one virtual visit during the first six months of 2020. Overall, the results suggest widespread physician and patient adoption of virtual care in response to the pandemic, and older age and lower income do not seem to be barriers to receiving virtual care.

Our study supports some of the early research demonstrating increased uptake of virtual care during the pandemic. Alexander and colleagues demonstrated virtual care use increased from 4% pre-pandemic to 35% during the pandemic in U.S. primary care practices, while Baum and colleagues noted that the use of virtual care in Veterans doubled during the pandemic.[4,5] Similarly Mehrotra and colleagues noted rapid increases in virtual care use during the pandemic in a commercially insured US population.[8] Crucially, these studies were limited to particular subsets of the U.S. population and thus had limited ability to provide a comprehensive population-level evaluation of virtual care utilization.

Our results support these early findings, but substantially add to the existing literature for a few reasons. This study is population based, that encompasses all 14.6 million residents of Ontario, which is demographically, culturally and geographically diverse. Universal healthcare coverage allows us to capture virtual care use from a number of groups, including vulnerable populations, that otherwise would be excluded from studies of commercial insurance. Finally, we have not only captured virtual care use in primary care, but specialty care as well.

Pre-pandemic, virtual care was supported in Ontario with the assumption that this technology could increase access, improve convenience, and reduce travel costs for patients. Pre-pandemic adoption had been quite modest despite significant digital health investments made by both the federal and provincial governments.[9-11] Research suggested that barriers to virtual care uptake pre-pandemic included limited physician reimbursement, along with government mandates that virtual visits in Ontario use an approved video platform.[12] The COVID-19 pandemic changed the

calculus as payers and providers came to recognize the need to minimize face-to-face contact between patients and providers to reduce transmission risk, the need to physically distance, and the need to conserve personal protective equipment.[13]

Ontario reacted quickly and decisively by introducing new billing codes that allowed and encouraged physicians to conduct virtual care using telephone or commercial videoconferencing software (Skype, Zoom, etc.). Our analysis demonstrates that while video visits increased modestly during January-June 2020, the majority of virtual care was provided through telephone visits. Our results suggest the crucial role of government modification of payment rules in enabling the transition to virtual care in response to COVID.

Despite the interest and investment in technology to enable video visits, telephone visits are easy to use and inexpensive with technology that is commonly available. The lack of the need for broadband, particularly in rural and northern parts of the province, and the lack of friction to scale quickly are also potential advantages of telephone over video visits.[14] The higher use of telephone visits over video visits is supported in the literature[9,15], and in health systems that rely on large virtual care programs, telephone calls and asynchronous messaging still represent the bulk of the virtual care provided.[16]

The uptake of virtual visits during the early months of COVID was similar among both lower and higher income patients is an important finding. There is widespread concern that lower income patients may be less likely to have smartphones and broadband access and that, as a consequence, virtual care is thought to have a potential to worsen income disparities. Our

finding suggests otherwise. Likewise, our finding of similar adoption of virtual care for older and younger patients seems to dispute the assumption that older patients are less comfortable with technology and therefore would be less likely to use virtual care. It is also important to recognize that COVID mortality increases significantly with age; thus older adults are at the highest risk from infection and thus are precisely the population who would be expected to benefit the most from avoiding in-person visits when a reasonable substitute (virtual visits) is available. Our data suggests barriers to virtual care adoption among this group may not be as significant as initially thought.[17]

Our finding that virtual care use increased similarly for all conditions during the COVID pandemic is also noteworthy. Prior research suggesting that virtual care may be particularly effective for mental health may explain the higher use of virtual care in this population. Virtual care has also been demonstrated to improve care for patients with Heart Failure[18], COPD[19,20], Coronary Artery Disease[21], and Diabetes[22]. Further study is required to understand which diseases and conditions are most amenable to virtual care, the correct dosing of virtual care (frequency of visits, duration), and content of visits (e.g., symptom assessment, medication reconciliation, etc.).

Our study has several limitations that warrant brief mention. First, we lack the clinical indications for these virtual visits and the requisite detail to assess the content or quality of care of the visits. Likewise, further study is needed to assess the quality of virtual visits relative to in-person visits as well as impact on patient outcomes. Our reliance on administrative billing codes precludes us from knowing precisely what type of technological modality (e.g., phone, unsecure

videoconference such as FaceTime) was used by physicians who billed the temporary codes. Finally, our study was conducted in a single payor health system and the results may not be generalizable to other settings, particularly health care systems that do not have universal coverage or are multi-payor.

CONCLUSIONS

In response to the COVID-19 pandemic, Ontario responded with changes that facilitated widespread adoption of virtual visits as a substitute for in-person care. Importantly, utilization of virtual care increased to similar degrees across the entire population including traditionally vulnerable subgroups. Future research should focus on how to assess the quality of virtual care and to identify diseases and patient subgroups where virtual care may be less effective than in-person visits.

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Table 1. Characteristics of patients who received at least 1 telemedicine visit in 2012, 2016, and 2020

VARIABLE	2012 (N=51,186)	2016 (N=146,104)	2020 (N=4,927,830)	P-VALUE
AGE CATEGORY				< 0.0001
<18	3,379 (6.6%)	10,217 (7.0%)	523,361 (10.6%)	
18-49	27,028 (52.8%)	74,561 (51.0%)	1,822,278 (37.0%)	
50-64	10,874 (21.2%)	34,954 (23.9%)	1,232,489 (25.0%)	
65-79	7,437 (14.5%)	19,956 (13.7%)	992,640 (20.1%)	
>=80	2,468 (4.8%)	6,416 (4.4%)	357,062 (7.2%)	
SEX				< 0.0001
FEMALE	25,270 (49.4%)	73,102 (50.0%)	2,786,826 (56.6%)	
MALE	25,916 (50.6%)	73,002 (50.0%)	2,141,004 (43.4%)	
REGION				< 0.0001
CENTRAL	4,609 (9.0%)	18,403 (12.6%)	1,707,781 (34.7%)	
EAST	17,556 (34.3%)	38,709 (26.5%)	1,229,707 (25.0%)	
NORTH	20,389 (39.8%)	45,413 (31.1%)	238,786 (4.8%)	
TORONTO	1,963 (3.8%)	4,337 (3.0%)	454,743 (9.2%)	
WEST	6,669 (13.0%)	39,242 (26.9%)	1,296,813 (26.3%)	
INCOME QUINTILE				< 0.0001
1	13,658 (26.7%)	41,111 (28.1%)	943,988 (19.2%)	
2	10,182 (19.9%)	30,966 (21.2%)	974,288 (19.8%)	
3	9,563 (18.7%)	27,545 (18.9%)	1,002,696 (20.3%)	
4	8,362 (16.3%)	23,974 (16.4%)	999,831 (20.3%)	
5	8,961 (17.5%)	22,247 (15.2%)	999,455 (20.3%)	
MISSING	460 (0.9%)	261 (0.2%)	7,572 (0.2%)	
LEVEL OF RURALITY (RIO SCORE)				< 0.0001
URBAN (<40)	33,356 (65.2%)	112,721 (77.2%)	4,604,587 (93.4%)	
RURAL (≥40)	14,666 (28.7%)	27,145 (18.6%)	290,401 (5.9%)	
MISSING	3,164 (6.2%)	6,238 (4.3%)	32,842 (0.7%)	

FIGURE 1A. NUMBER OF VIRTUAL VISITS COMPARED TO TOTAL AMBULATORY VISITS BY QUARTER, 2012-2020

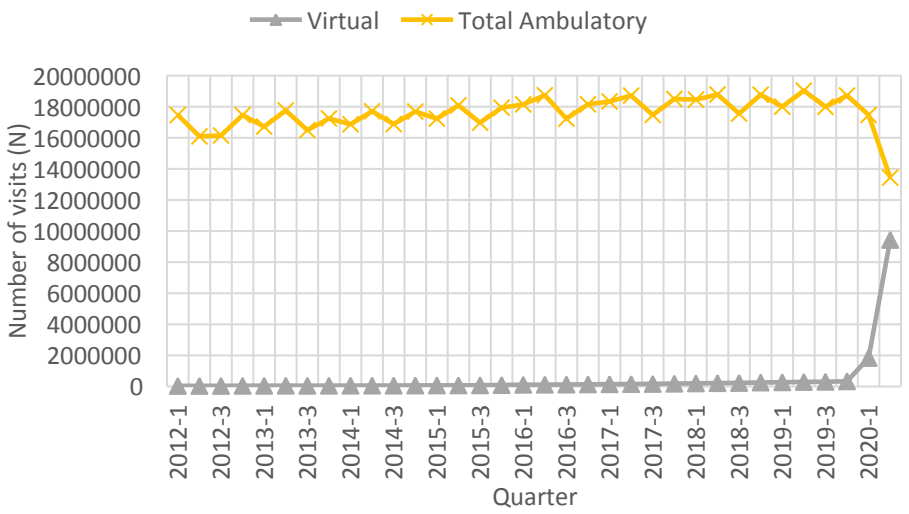


FIGURE 1B. PERCENT OF VIRTUAL VISITS COMPARED WITH TOTAL AMBULATORY VISITS BY QUARTER, 2012-2020

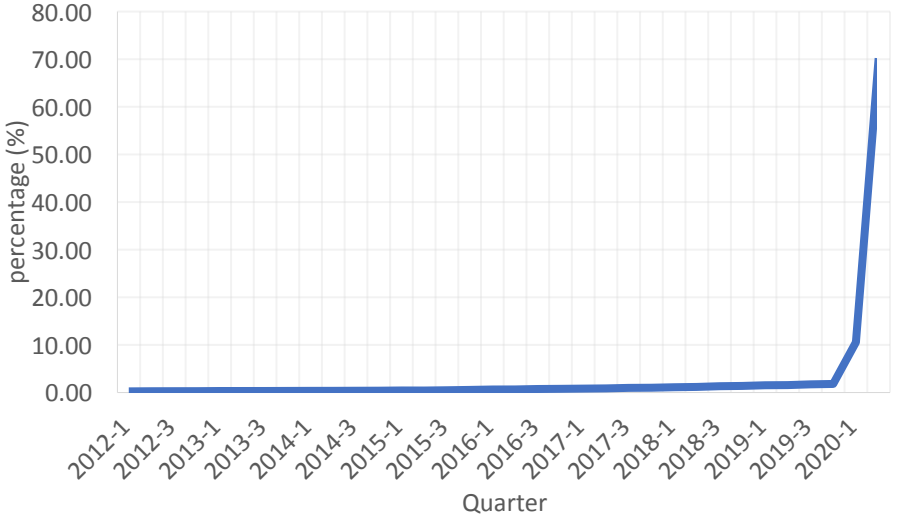


FIGURE 1C. PERCENT OF ELIGIBLE ONTARIO PATIENTS WITH VIRTUAL VISITS BY QUARTER, 2012-2020

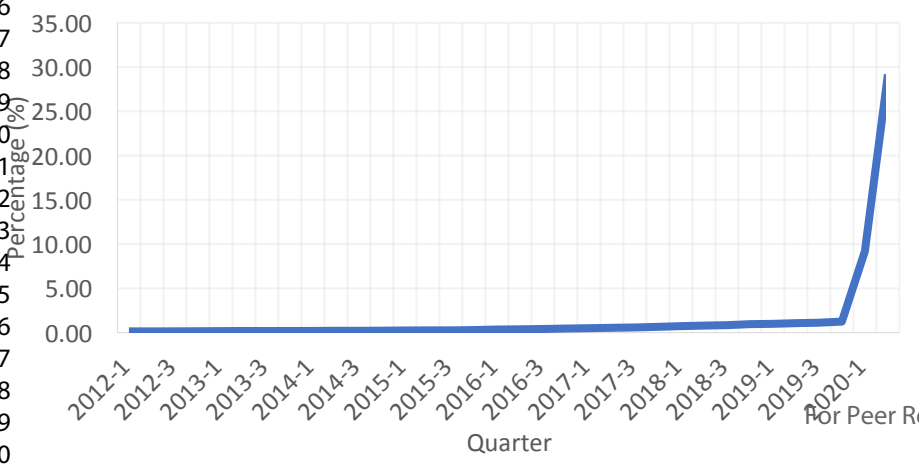
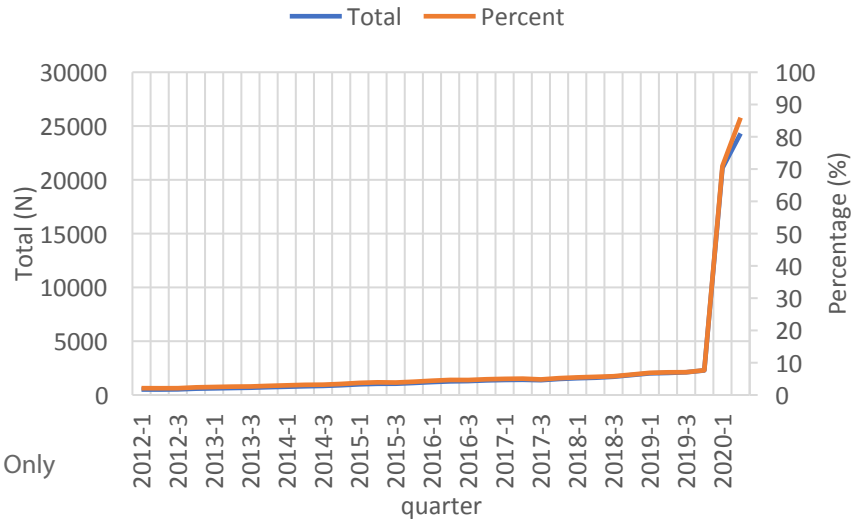
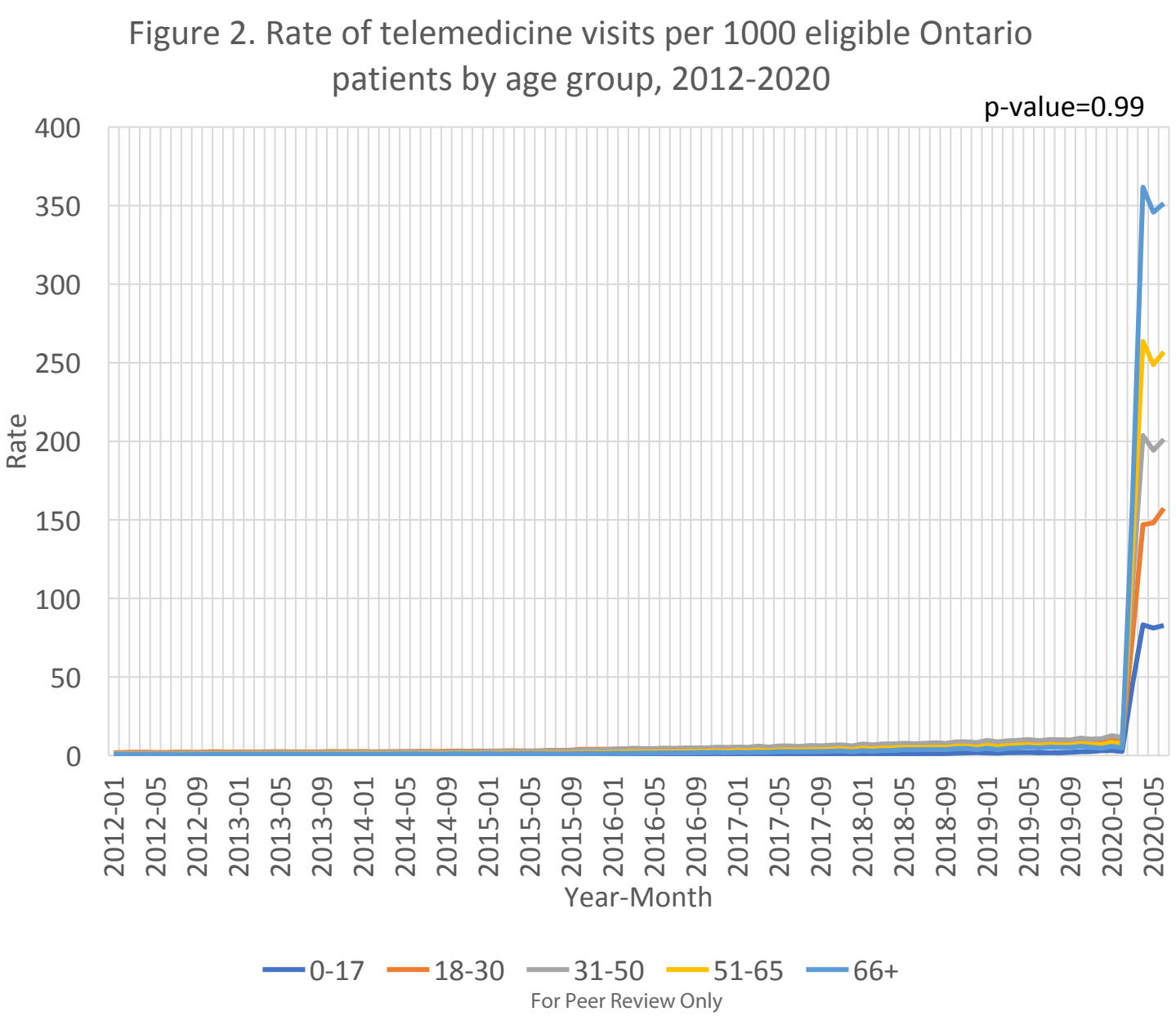


FIGURE 1D. N(%) OF PROVIDERS WHO PROVIDED VIRTUAL CARE BY QUARTER, 2012-2020





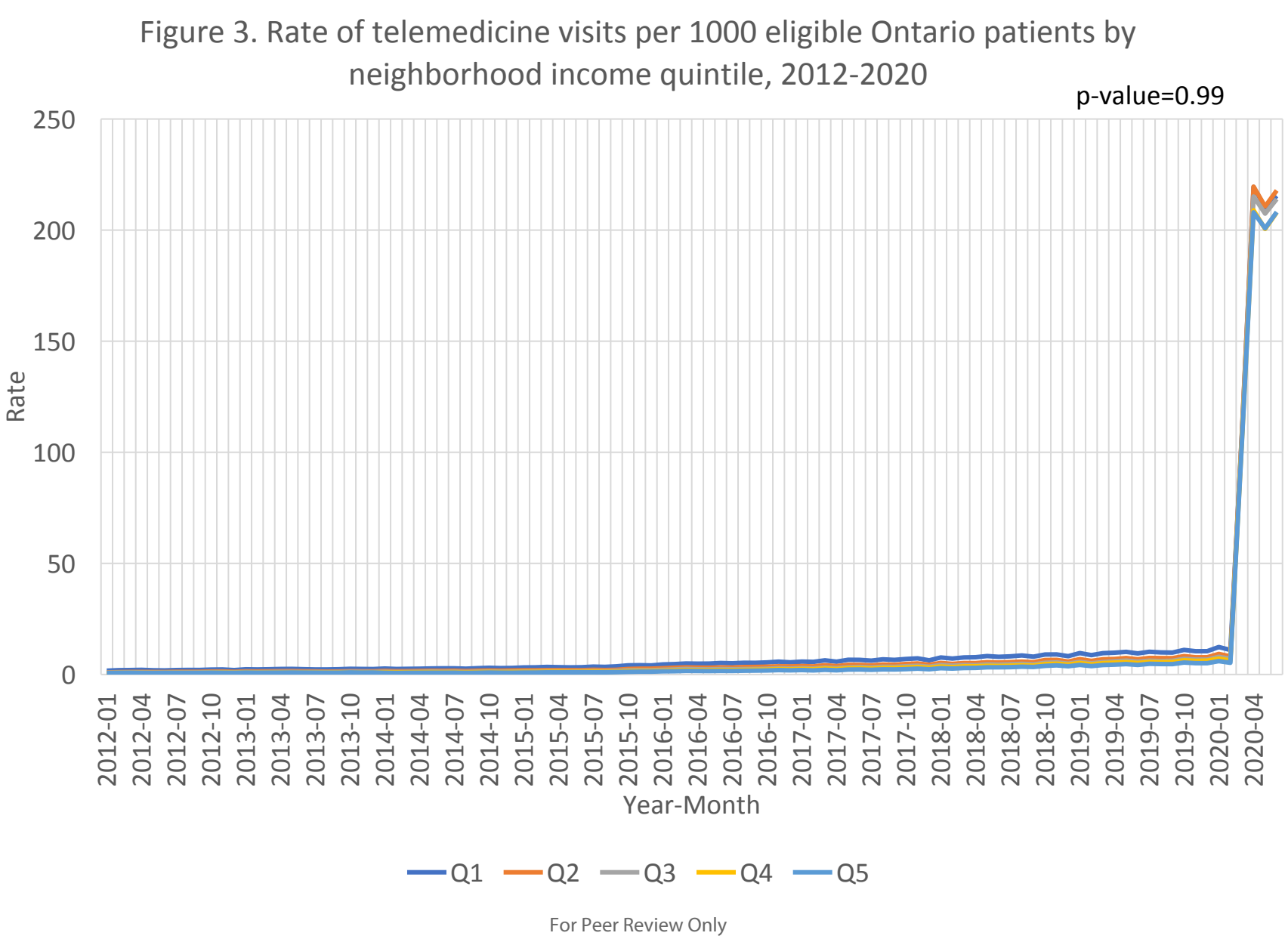
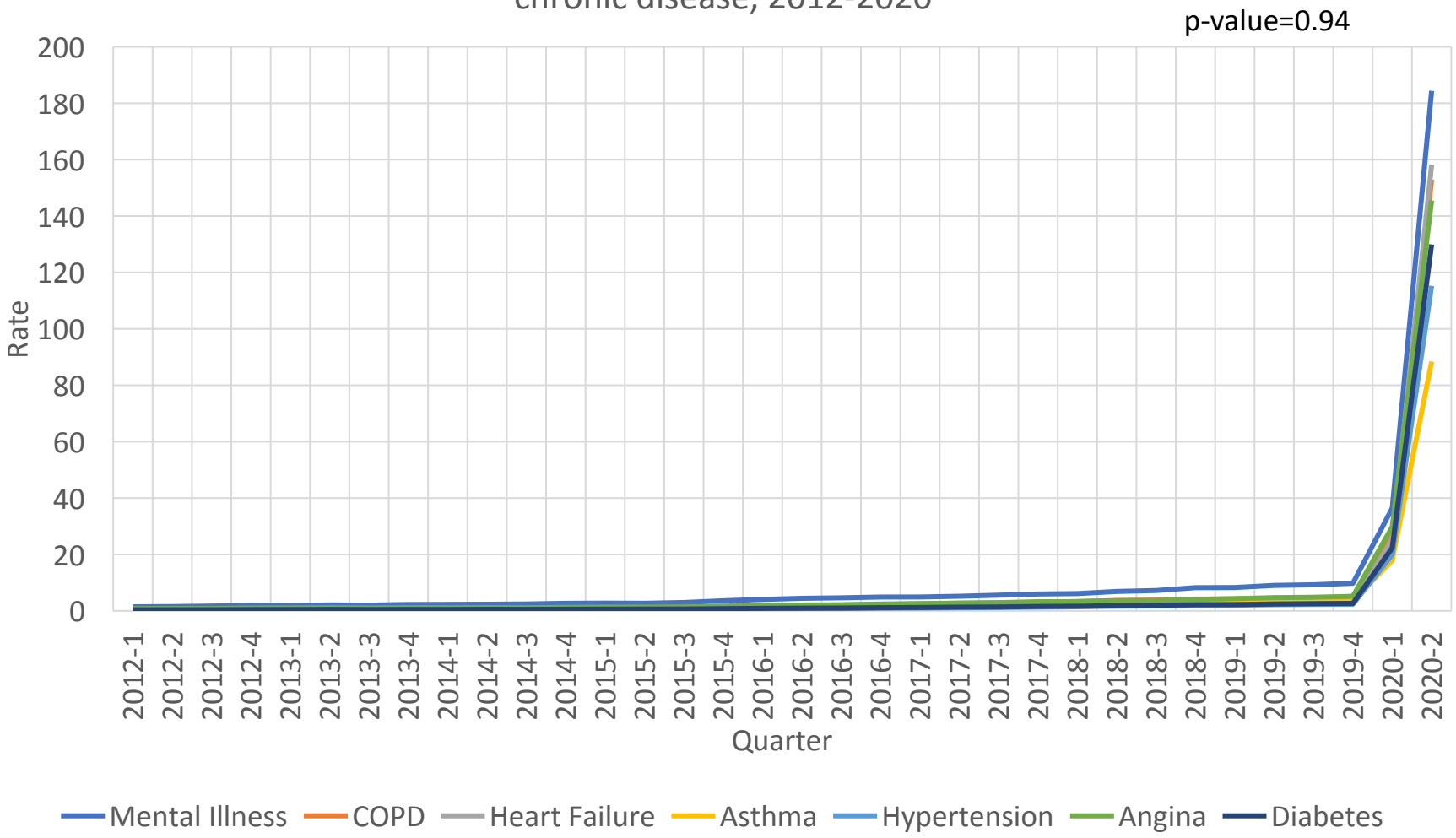
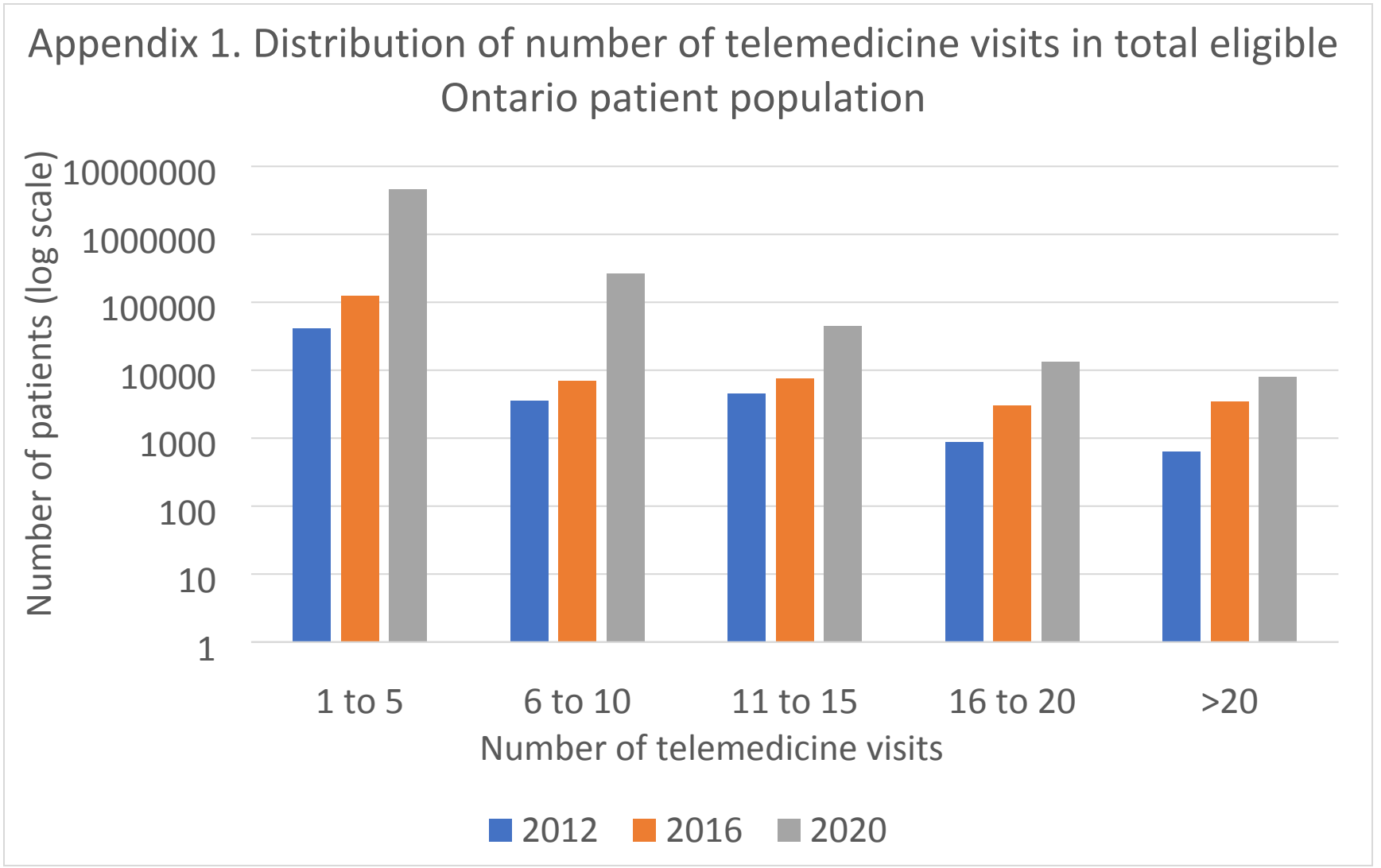


Figure 4. Rate of telemedicine visits per 100 eligible Ontario patients by chronic disease, 2012-2020




Appendix 1. Distribution of number of telemedicine visits in total eligible Ontario patient population
Number of patients (log scale)
10000000
1000000
100000
10000
1000
100
10
1
1 to 5
6 to 10
11 to 15
16 to 20
>20
Number of telemedicine visits
2012
2016
2020

Supplemental Table 1. Billing Codes for Virtual Care

Time Period	Billing Codes	Modality
January 1, 2012- June 30, 2020	B100, B200, B099	Video-visit
April 1, 2020- June 30, 2020	B103, B203, B209	Video-visit
March 14, 2020- June 30, 2020	K080, K081, K082, K083, H409, H410	All telemedicine modalities

Supplemental Table 2. Inclusion Criteria for Chronic Disease Patient Cohorts

Chronic Disease	Inclusion Criteria
Serious mental illness	Patients with **serious mental illness** that affects functioning, characterized by at least 2 outpatient or 1 inpatient claims with the corresponding ICD 9 or 10 codes or DXCODES within 12 months prior to year of interest [NACRS, OHIP, DAD]: <u>Schizophrenia and psychotic disorders:</u> DAD/NACRS: ICD-9=295, 297 ICD-10= F20.0, F20.1, F20.2, F20.5, F20.9, F20.81, F20.89, F22, F23, F24, F25.9 OHIP DXCODES: 295, 297, 298 <u>Bipolar disorder:</u> DAD/NACRS: ICD-9=296.0, 296.1, 296.4-296.6, 296.7, 296.8, 296.9, 301.11, 301.13 ICD-10=F30.1, F30.2, F30.3, F30.4, F30.8, F31.1, F31.2, F31.3, F31.4, F31.5, F31.6, F31.73, F31.74, F31.75,

	F31.76, F31.77, F31.78, F31.81, F31.9, F32.8, F34.0, F34.8, F39, F60.89 OHIP DXCODES: 296
COPD	Record in the ICES COPD database any time prior to year of interest
Heart failure	Record in ICES CHF database any time prior to year of interest
Asthma	Record in ICES ASTHMA database any time prior to year of interest
Hypertension	Record in the ICES HYPER database any time prior to year of interest
Angina	At least one ED visit within 12 months prior to year of interest with any of the following codes [NACRS, OHIP]: ICD-9: 411.1, 413.0, 413.1, 413.9, 786.51, 786.52 ICD-10: R07.1–R07.4, I20.0, I20.1, I20.8, I20.88, or I20.9
Diabetes	Record in the ICES ODD database any time prior to year of interest