Primary care utilization for patients with newly diagnosed cancer during the COVID-19 pandemic: a population-based study

Ying Ling1*, Matthew C. Cheung1,2,3, Kelvin K.W. Chan2,3,4,5, Aisha Lofters3,6,7, Colleen Fox8, Aditi Patrikar3, Ning Liu3,5 and Simron Singh2,3,4,5

Abstract

Background  The COVID-19 pandemic greatly impacted primary care and cancer care. We studied how primary care utilization in Ontario, Canada changed for patients who were newly diagnosed with cancer just prior to the COVID-19 pandemic compared to those diagnosed in non-pandemic years.

Methods  This population-based, retrospective cohort study used linked healthcare databases to compare outcomes for patients with a new malignancy diagnosed within the year prior to the COVID-19 pandemic, between July 1 and September 30, 2019 (COVID-19 cohort) to those diagnosed in the same months in 2018 and 2017 (pre-pandemic cohort). We used Poisson regression models to compare rates of in-person and virtual visits to patients’ usual primary care physician (PCP), emergency department (ED) visits, and hospitalizations, all reported per person-year of follow-up.

Results  In-person visits to usual PCPs decreased from 4.07/person-year in the pre-pandemic cohort to 2.58 in the COVID-19 cohort (p < 0.0001). Virtual visits to usual PCPs increased from 0.00 to 1.53 (p < 0.0001). Combined in-person and virtual visits to patients’ usual PCPs was unchanged from 4.07 to 4.12 (p = 0.89). The rate of ED visits decreased from 0.99/person-year to 0.88 (p < 0.0001). Non-elective hospitalizations remained unchanged, from 0.49/person-year to 0.47 (p = 0.1675).

Conclusion  There was a sizeable shift in primary care visits for cancer patients from in-person to virtual during the pandemic, although there was no resultant increase in hospitalizations. This suggests that early in the pandemic, virtual care allowed for continuity in utilization of primary care, though further studies are required to confirm this persisted later in the pandemic.

Keywords  Primary care, Cancer, COVID-19 pandemic, Virtual care
Introduction
Primary care physicians (PCPs) form an important backbone of our healthcare system. They are often the first to detect a possible diagnosis of cancer, either through routine screening or symptom assessment. During cancer treatment, they continue to provide support through monitoring of comorbidities and non-cancer related medications. The COVID-19 pandemic rapidly changed the delivery of primary care. Compared to tertiary hospitals, primary care clinics had more initial uncertainty regarding personal protective equipment availability and infrastructure to develop safe physical distancing protocols for in-person visits. Additionally, many PCPs were called upon to provide support for COVID-19 testing sites, assessment centres, and long term care facilities [1]. In Ontario, Canada, similar to elsewhere in the world, there were large shifts from in-person care to virtual care for PCPs during the COVID-19 pandemic, often with little preparation [2].

Cancer care has also been greatly affected by the COVID-19 pandemic. In the United States, cancer-related patient encounters and screening decreased over 40% and 80% respectively in 2020 compared to 2019 [3]. In Ontario, Canada, the provincial cancer screening programs delivered 41% fewer screening tests in 2020 compared to 2019 [4]. A modelling study from the United Kingdom predicted increases in avoidable deaths resulting from delays in cancer diagnosis due to the COVID-19 pandemic [5]. However, the true impact of the pandemic on primary care utilization for cancer patients and the downstream clinical consequences remains unclear. We aimed to understand how primary care utilization in Ontario, Canada changed for patients who were newly diagnosed with cancer just prior to the COVID-19 pandemic compared to those diagnosed in non-pandemic years.

Methods
Study design and data sources
We undertook a population-based, retrospective cohort study using linked healthcare administrative databases held at ICES in Ontario, Canada. ICES is an independent, non-profit research institute whose legal status under Ontario’s health information privacy law allows it to collect and analyze healthcare and demographic data for health system evaluation and improvement. The use of these data for our project did not require review by the Research Ethics Board as it complied with Sect. 45 of Ontario’s Personal Health Information Protection Act. Permanent residents of Ontario receive full medical care coverage through the province’s universal and publicly funded insurance plan, the Ontario Health Insurance Plan (OHIP). All linked data for eligible individuals in our study were linked using unique encoded identifiers and analyzed at ICES (see Appendix for database details on ICES databases used).

Study population
Patients aged between 18 and 100 years with a new breast, lung, colorectal, prostate, hematologic, or head and neck squamous cell malignancy diagnosed within the year prior to the COVID-19 pandemic, between July 1, 2019 and September 30, 2019 (COVID-19 cohort) were compared to patients diagnosed in years unaffected by the COVID-19 pandemic, between July 1, 2018 – September 30, 2018 and July 1, 2017 – September 30, 2017 (pre-pandemic cohort). These malignancies were selected as they are the most common cancers to affect the adult population. These dates were selected due to the Ontario Cancer Registry (OCR) only having malignancy diagnostic data updated to September 2019 at the time of study. Nonetheless, as patients were followed for 12 months after initial cancer diagnosis, in the COVID-19 cohort, this allowed for up to 7 months of follow-up data occurring during the COVID-19 pandemic. The months were kept constant in each cohort to control for seasonal variation. Patients were excluded if they had a prior diagnosis of cancer, had another cancer diagnosed within the follow-up period, did not have a valid healthcare number, and did not have a primary care visit in the 2 years prior to their cancer diagnosis.

Outcomes and measures
The primary outcome was the rate of in-person and virtual visits to PCPs per person-year of follow-up. PCP visits were identified using OHIP outpatient visit billing codes linked to specialty codes for family medicine/general practice and community medicine. Virtual visits included telephone or video calls identified through temporary OHIP virtual care codes implemented during the pandemic and pre-existing telemedicine care codes in the historical periods. Codes used specifically for videoconferencing through the Ontario Telemedicine Network were also included (Supplementary Table 3). We also assessed the rate of in-person and virtual visits to a patient’s usual PCP, identified either through a patient being rostered to that PCP through a primary care enrollment model, or the bulk of the patient’s primary care visits in the prior 2 years to that PCP if a patient is not rostered.

Secondary outcomes included rate of in-person and virtual visits to a specialist, emergency department (ED) visits, and hospitalizations. Specialist visits were further stratified into all specialists, hematologists, medical oncologists, and radiation oncologists using OHIP specialty codes. Hospitalization data were collected for all acute-care hospitalizations and specifically non-elective hospitalizations. Due to an observation in cancer clinics
during the COVID-19 pandemic that patients reported difficulty seeing their PCPs for non-cancer related prescription refills, we also assessed the rate of prescriptions written by specialists for medications typically provided by PCPs in patients aged 65 or older (anti-hypertensives, oral hypoglycemic agents and insulins, statins, and thyroid replacements as documented within the Ontario Drug Benefits Claims database, Supplementary Table 4).

Statistical analysis
Primary and secondary outcomes, reported as rate of visits per person-year of follow-up, were calculated separately for the COVID-19 cohort and the pre-pandemic cohort by dividing the total number of visits by the total person-years of follow-up for each cohort. The 95% confidence intervals (CI) of rates were generated assuming number of visits following a Poisson distribution. We used Poisson regression models to compare rates of visits between the COVID-19 cohort and the pre-pandemic cohort. SAS 14.3 was used for the analysis.

To assess the impact of changes in primary care practice during the COVID-19 pandemic on ED visits and non-elective hospitalizations, we additionally conducted a nested case control study within the COVID-19 cohort to compare exposures in patients who had an ED visit or non-elective hospitalization during the pandemic to those who did not. Cases were patients who had a non-COVID related ED visit or non-elective hospitalization (identified if there was no positive COVID-19 test on the Ontario Laboratories Information System database between 1 month before to 1 week after), occurring between June 1, 2020 and their 12-month follow-up from initial cancer diagnosis. This period was selected to allow a 3-month lookback window for assessment of exposures occurring during the COVID-19 pandemic. The index date for cases was defined as their first non-COVID related ED visit or non-elective hospitalization. Controls, also taken from the COVID-19 cohort, did not have an ED visit or non-elective hospitalization between June 1, 2020 and their 12-month follow-up, and were 2:1 matched in cancer type, age, sex, and co-morbidity index. The pseudo-index date for the controls was then assigned to equate the same time from cancer diagnosis to the index date for the matched case counterpart; those with pseudo-index dates falling before June 1, 2020 were removed from analysis. Exposures of interest were having an above median number of in-person and virtual visits to PCPs and specialists, having one or more prior ED visit or non-elective hospitalization (occurring from initial cancer diagnosis up to June 1, 2020), metastatic cancer stage, and exposure to chemotherapy and radiation therapy. Odds ratios were calculated using logistic regression.

Results
We identified 17,545 patients diagnosed with a new breast, lung, colorectal, prostate, hematologic, or head and neck squamous cell malignancy during the COVID-19 cohort timeframe with 15,775 person-years of follow-up, and 36,362 patients diagnosed with a new malignancy during the pre-pandemic cohort timeframe with 31,696 person-years of follow-up. Table 1 summarizes baseline patient characteristics and Table 2 summarizes characteristics of the patients’ usual PCPs.

Primary care visits
The rate of in-person visits to all PCPs decreased from 7.08 visits per person-year [95% CI 7.05–7.11] in the pre-pandemic cohort to 4.79 [4.76–4.82] in the COVID-19 cohort, corresponding to a 2.29 visits per person-year rate difference. Virtual visits to all PCPs per person-year increased from 0.06 [0.06–0.07] to 2.18 [2.16–2.20], an increase of 2.12 visits per person-year. When combining in-person and virtual visits to all PCPs, there was a decline from 7.14 [7.11–7.17] to 6.97 [6.93–7.01], a decrease of 0.17 visits per person-year (Fig. 1 A).

Similar findings were seen for rate of visits to usual PCPs. In-person visits to usual PCPs decreased from 4.07 visits per person-year [4.04–4.09] to 2.58 [2.56–2.61], a decrease of 1.49 visits per person-year, while virtual visits increased from 0.00 [0.00–0.01] to 1.53 [1.52–1.55], an increase of 1.53 visits per person-year. Combined in-person and virtual visits to usual PCPs did not change substantially, from 4.07 [4.05–4.09] to 4.12 [4.08–4.15].

Specialist visits
The rate of in-person visits to all specialists decreased from 14.42 visits per person-year [14.38–14.46] in the pre-pandemic cohort to 11.96 [11.91–12.01] in the COVID-19 cohort, a decrease of 2.46 visits per person-year. Virtual visits to all specialists per person-year increased from 0.17 [0.17–0.18] to 2.80 [2.77–2.83], an increase of 2.63 visits per person-year. Combined in-person and virtual visits to all specialists increased from 14.60 [14.55–14.64] to 14.76 [14.70–14.82], an increase of 0.16 visits per person-year (Fig. 1 B).

When stratifying visits specifically to oncologists, in-person visits decreased from 2.85 [2.83–2.86] to 2.30 [2.28–2.33] for medical oncologists, 1.10 [1.09–1.11] to 0.91 [0.89–0.92] for hematologists, and 2.86 [2.84–2.88] to 2.25 [2.22–2.27] for radiation oncologists, a decrease of 0.55, 0.19, and 0.61 visits per person-year respectively. Virtual visits to medical oncologists, hematologists and radiation oncologists increased from 0.06 [0.06–0.07] to 0.65 [0.64–0.67], 0.02 [0.02–0.02] to 0.18 [0.17–0.19], and 0.06 [0.05–0.06] to 0.53 [0.52–0.54], representing increases of 0.59, 0.16, and 0.47 visits per person-year respectively. Combined in-person and virtual visits to
Table 1 Baseline patient characteristics

| Characteristic                        | Pre-Pandemic Cohort (n = 36,362) | COVID-19 Cohort (n = 17,545) | Standardized Difference |
|---------------------------------------|-----------------------------------|------------------------------|-------------------------|
| Sex                                   | 17,675 (48.6%)                    | 8,886 (50.6%)                | 0.041                   |
| Age at index date (cancer diagnosis)  |                                   |                              |                         |
| Mean (SD)                             | 59.01 (12.18)                     | 58.54 (12.03)                | 0.039                   |
| Median (IQR)                          | 59 (51–67)                        | 59 (51–67)                   | 0.038                   |
| Cancer type, n(%)                     |                                   |                              |                         |
| Breast                                | 8,580 (23.6%)                     | 4,528 (25.8%)                | 0.051                   |
| Colorectal                            | 5,698 (15.7%)                     | 2,833 (16.1%)                | 0.013                   |
| Head and neck                         | 1,646 (4.5%)                      | 793 (4.5%)                   | 0.000                   |
| Hematologic                           | 5,977 (16.4%)                     | 2,882 (16.4%)                | 0.000                   |
| Lung                                  | 6,770 (18.6%)                     | 3,103 (17.7%)                | 0.024                   |
| Prostate                              | 7,691 (21.2%)                     | 3,406 (19.4%)                | 0.043                   |
| Cancer stage, n(%)                    |                                   |                              |                         |
| Metastatic                            | 6,001 (16.5%)                     | 1,678 (9.6%)                 | 0.21*                   |
| Non-metastatic                        | 21,799 (59.9%)                    | 5,839 (33.3%)                | 0.56*                   |
| Missing                               | 8,562 (23.5%)                     | 10,028 (57.2%)               | 0.73*                   |
| Income quintile, n(%)                 |                                   |                              |                         |
| 1                                     | 7,148 (19.7%)                     | 3,395 (19.4%)                | 0.008                   |
| 2                                     | 7,517 (20.7%)                     | 3,527 (20.1%)                | 0.014                   |
| 3                                     | 7,230 (19.9%)                     | 3,515 (20.0%)                | 0.004                   |
| 4                                     | 6,955 (19.1%)                     | 3,429 (19.5%)                | 0.011                   |
| 5                                     | 7,404 (20.4%)                     | 3,627 (20.7%)                | 0.008                   |
| Missing                               | 108 (0.3%)                        | 52 (0.3%)                    | 0.000                   |
| ON-Marg material deprivation index, n(%) |                                   |                              |                         |
| 1                                     | 7,810 (21.5%)                     | 3,877 (22.1%)                | 0.013                   |
| 2                                     | 7,383 (20.3%)                     | 3,580 (20.4%)                | 0.009                   |
| 3                                     | 7,063 (19.4%)                     | 3,444 (19.6%)                | 0.003                   |
| 4                                     | 7,011 (19.3%)                     | 3,286 (18.7%)                | 0.017                   |
| 5                                     | 6,807 (18.7%)                     | 3,215 (18.3%)                | 0.011                   |
| Missing                               | 288 (0.8%)                        | 143 (0.8%)                   | 0.01                    |
| ON-Marg dependency index, n(%)        |                                   |                              |                         |
| 1                                     | 6,471 (17.8%)                     | 3,284 (18.7%)                | 0.026                   |
| 2                                     | 6,494 (17.9%)                     | 3,127 (17.8%)                | 0.000                   |
| 3                                     | 6,558 (18.0%)                     | 3,251 (18.5%)                | 0.011                   |
| 4                                     | 6,968 (19.2%)                     | 3,242 (18.5%)                | 0.02                    |
| 5                                     | 9,583 (26.4%)                     | 4,498 (25.6%)                | 0.018                   |
| Missing                               | 288 (0.8%)                        | 143 (0.8%)                   | 0.01                    |
| ON-Marg ethnic concentration index, n(%) |                                   |                              |                         |
| 1                                     | 7,543 (20.7%)                     | 3,621 (20.6%)                | 0.008                   |
| 2                                     | 7,108 (19.5%)                     | 3,476 (19.8%)                | 0.005                   |
| 3                                     | 6,822 (18.8%)                     | 3,164 (18.0%)                | 0.015                   |
| 4                                     | 6,887 (18.9%)                     | 3,323 (18.9%)                | 0.001                   |
| 5                                     | 7,714 (21.2%)                     | 3,818 (21.8%)                | 0.015                   |
| Missing                               | 288 (0.8%)                        | 143 (0.8%)                   | 0.01                    |
| ON-Marg residential instability index, n(%) |                                   |                              |                         |
| 1                                     | 6,557 (18.0%)                     | 3,329 (19.0%)                | 0.014                   |
| 2                                     | 6,779 (18.6%)                     | 3,319 (18.9%)                | 0.005                   |
| 3                                     | 7,146 (19.7%)                     | 3,386 (19.3%)                | 0.003                   |
| 4                                     | 6,982 (19.2%)                     | 3,350 (19.1%)                | 0.006                   |
| 5                                     | 8,610 (23.7%)                     | 4,018 (22.9%)                | 0.018                   |
| Missing                               | 288 (0.8%)                        | 143 (0.8%)                   | 0.01                    |

Collective Co-morbidity burden (ADGs), n(%)
medical oncologists and hematologists did not change substantially, from 2.91 [2.89–2.93] to 2.96 [2.93–2.98] and from 1.11 [1.10–1.13] to 1.09 [1.07–1.10] respectively. Combined visits to radiation oncologists decreased from 2.92 [2.90–2.94] to 2.78 [2.75–2.80].

Prescriptions for primary care medications
There was no significant change in the number of specialist prescriptions for medications typically prescribed by PCPs (Supplementary Table 4), from 0.37 [0.33–0.41] per person-year in the pre-pandemic cohort to 0.40 [0.35–0.46] in the COVID-19 cohort. Prescriptions for these medications written by PCPs also did not change substantially, from 2.56 [1.98–3.31] in the pre-pandemic cohort to 2.83 [2.00–4.00] in the COVID-19 cohort.

ED visits and hospitalizations
The rate of visits to the ED decreased from 0.99 [0.98–1.00] per person-year in the pre-pandemic cohort to 0.88 [0.87–0.90] in the COVID-19 cohort, a decrease of 0.11 visits per person-year. Total hospitalizations decreased from 0.85 [0.84–0.86] to 0.81 [0.80–0.83], a decrease of 0.04 visits per person-year, but non-elective hospitalizations did not substantially change, from 0.49 [0.48–0.50] to 0.47 [0.46–0.49].

Within the COVID-19 cohort, we identified 2,460 patients who had an ED visit (cases) and 3,334 patients who did not have an ED visit (controls) occurring between June 1, 2020 and their 12-month follow-up. Exposures that increased odds for an ED visit included having above the median number of virtual visits to a PCP, in-person or virtual visits to a specialist, or chemotherapy in the 3-month lookback window, as well as metastatic cancer stage and 1 or more ED visit prior to June 1, 2020 (Table 3).

We identified 988 patients who had a non-elective hospitalization (cases) and 1,366 patients who did not have a non-elective hospitalization (controls) within the COVID-19 cohort occurring between June 1, 2020 and their 12-month follow-up. Exposures that increased odds for a non-elective hospitalization included increased number of in-person or virtual visits to a PCP, in-person visits to a specialist, or chemotherapy in the 3-month lookback window, as well as metastatic cancer and 1 or more non-elective hospitalizations prior to June 1, 2020 (Table 4).

Discussion
In this large, population-based, retrospective cohort study of patients with newly diagnosed malignancies, we describe a major shift in ambulatory practices during the COVID-19 pandemic from in-person to virtual care. In the primary care setting, there was a slight decrease in the rate of combined visits to all PCPs, though the absolute difference was small, and there was no significant difference in the rate of combined visits to patients’ usual PCPs. Combined visits to all specialists increased slightly during the pandemic, with no meaningful difference noted for visits specifically to hematologists or medical oncologists. The rate of ED visits and total hospitalizations decreased in the COVID-19 cohort, a phenomenon that has been well described during the early pandemic, likely due to multiple factors including patient concerns of COVID-19 exposure as well as stay-at-home orders [6–8]. However, we found no significant difference in the rate of non-elective hospitalizations between the two cohorts.

From the start of the pandemic, there has been substantial concern from both patients and practitioners on the impact of COVID-19 for cancer patients. A systematic review found 62 studies that identified 38 different
categories of delays and disruptions to cancer services including impacts on diagnosis and treatment, though there was no specific comment on use of primary care [9]. In Ontario, Canada, many public health interventions were put into place that could have affected regular healthcare use for cancer patients [10]. A study of primary care practices in our province found that total primary care visits decreased between March and July, 2020, but the smallest declines occurred in patients with expected high healthcare resource use [2]. For newly diagnosed cancer patients, a study in the United States found a higher uptake of telemedicine use within 30 days of cancer diagnosis in those with the highest socioeconomic status, though the downstream impact of this disparity was unclear [11]. A separate small study comparing the outcomes of 206 cancer patients newly starting systemic therapy in 2020, where at least one visit was virtual, to 105 patients in 2019, where all visits were in-person, found no difference in time to staging imaging, time to therapy initiation, 3 month ED visits and hospitalizations, or treatment delays [12]. In our much larger, population-based cohort study, we similarly found that the rapid shift in ambulatory practices during the pandemic to virtual medicine, even in the critically important domain of primary practice, did not compromise the care of newly diagnosed cancer patients by increasing unplanned hospital admissions.

We found that the rate of prescriptions written by specialists for medications that are commonly prescribed by primary care did not change substantially during the pandemic. In addition, PCPs did not write fewer prescriptions for these medications. Taken together, despite the anecdotal concern that patients had more difficulty reaching their PCPs for prescription refills, these findings suggest that virtual care adequately adapted to support ongoing care of baseline comorbidities in patients with new malignancies, and that utilization of PCPs was maintained.

Among patients in the COVID-19 cohort, chemotherapy exposure within the prior 3 months and metastatic cancer stage at diagnosis increased odds for an ED visit or non-elective hospitalization during the pandemic period, likely reflecting the higher care needs of these populations. Although we also noted a higher risk of ED visit/hospitalization associated with preceding increased outpatient visits to specialists and PCPs, further studies are needed to determine whether this was due to PCPs and specialists appropriately identifying higher risk patients and seeing them more frequently.

Some limitations of our study, given its population-scale data, include inability to obtain more granular data on specific reasons for outpatient visits, ED visits, and hospitalizations. These data also do not include assessment of important patient reported measures such as preference, experience, or satisfaction with changes during the pandemic. Additionally, these data do not account for variation in practice across the province. Our study excluded those with a second malignancy diagnosed during follow-up (1,785 in the pre-pandemic and 978 in the pandemic cohort) to ensure we knew to which diagnosis a visit corresponded; therefore, results cannot be generalized to patients with more than one cancer. The ICES databases vary in their updating timelines, and at the time of developing our study, we were limited by the lack of malignancy diagnostic data in the OCR beyond September 2019, and as a result, some follow-up data for the pandemic cohort occurs pre-pandemic. Consequently,
the reported rate differences in our study may not fully reflect changes in healthcare utilization before and during the pandemic. There was also delayed reporting of staging data, which limited our ability to properly match for or assess differences as a result of metastatic disease. However, since the diagnoses were made in July – September 2019, before cancer screening and diagnostic testing would have been affected by the pandemic, we would not expect to see large differences in proportion of more advanced disease between the two cohorts. We also do not have mature outcome data beyond 1 year after cancer diagnosis, and thus cannot generalize our findings to later waves of the pandemic or on longer term impacts on cancer patients with increased virtual care.
different method. No difference was seen in downstream
to visit their usual PCP during the pandemic, albeit in a

demic. We found that there was a sizeable shift in outpa
tient care from in-person to virtual, for both PCPs and
patients with newly diagnosed cancer during the COVID-19 pan

demic. While these findings suggest that in the short term, vir
tual care has allowed for stable utilization of primary care
for patients with cancer, further studies are required to
confirm this persists into later parts of the pandemic, ide
ally including a focus on the patient experience.

**List of abbreviations**

PCP Primary care physician
ED Emergency department
OHIP Ontario Health Insurance Plan
OCR Ontario Cancer Registry

**Supplementary Information**

The online version contains supplementary material available at https://doi.

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Not applicable.

**Author contribution**

YL, MC, and SS conceived the study and all authors contributed to the study
design. AP and NL analyzed the data and all of the authors interpreted the
data. YL drafted the manuscript and all of the authors revised the manuscript
critically for important intellectual content, approved the final version to be
published, and agreed to be accountable for all aspects of the work.

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authors and are independent from the funding sources. No endorsement by
the OHDP, its partners, or the Province of Ontario is intended or should be
inferred.

**Data availability**

The dataset from this study is held securely in coded form at ICES. While
data sharing agreements prohibit ICES from making the dataset publicly
available, access may be granted to those who meet pre-specified criteria
for confidential access, available at www.ices.on.ca/DAS. The full dataset
creation plan and underlying analytic code are available from the authors
upon request, understanding that the computer programs may rely upon
coding templates or macros that are unique to ICES and are therefore either
inaccessible or may require modification.

**Declarations**

**Ethics approval and consent to participate**

ICES is an independent, non-profit research institute whose prescribed
entity under Sect. 45 of Ontario’s Personal Health Information Protection Act
authorizes ICES to collect personal health information, without consent, for
the purpose of analysis or compiling statistical information with respect to
the management of, evaluation or monitoring of, the allocation of resources
to or planning for all or part of the health system. Projects conducted under
Sect. 45, by definition, do not require review by a Research Ethics Board. This
project was conducted under Sect. 45, and approved by the ICES Privacy and
Legal Office.

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**Table 3** Odds ratios for exposures within the COVID-19 cohort
for patients who had compared to those who did not have an ED
visit on or after June 1, 2020

| Exposure (3-month lookback unless otherwise indicated) | Odds Ratio (95% CI) | p value |
|--------------------------------------------------------|---------------------|---------|
| In-person visit to a PCP (above median)                | 1.09 (0.94–1.26)    | 0.26    |
| Virtual visit to a PCP (above median)                 | 2.35 (2.05–2.70)    | <0.0001 |
| In-person visit to a specialist (above median)        | 1.32 (1.15–1.52)    | 0.0001  |
| Virtual visit to a specialist (above median)          | 1.57 (1.22–2.01)    | 0.0004  |
| Radiation                                              | 1.19 (0.95–1.50)    | 0.13    |
| Chemotherapy                                           | 1.40 (1.21–1.62)    | <0.0001 |
| 1 or more prior ED visit (from time of initial cancer diagnosis up to June 1, 2020) | 1.91 (1.68–2.17)    | <0.0001 |
| Metastatic cancer stage (at diagnosis)                | 1.39 (1.10–1.76)    | 0.012   |

**Table 4** Odds ratios for exposures within the COVID-19 cohort
for patients who had compared to those who did not have a non-elective hospitalization on or after June 1, 2020

| Exposure (3-month lookback unless otherwise indicated) | Odds Ratio (95% CI) | p value |
|--------------------------------------------------------|---------------------|---------|
| In-person visit to a PCP (above median)                | 1.36 (1.10–1.69)    | 0.0041  |
| Virtual visit to a PCP (above median)                 | 1.85 (1.49–2.30)    | <0.0001 |
| In-person visit to a specialist (above median)        | 1.64 (1.34–2.07)    | <0.0001 |
| Virtual visit to a specialist (above median)          | 1.12 (0.79–1.58)    | 0.54    |
| Radiation                                              | 1.05 (0.74–1.49)    | 0.80    |
| Chemotherapy                                           | 1.46 (1.16–1.83)    | 0.0012  |
| 1 or more prior non-elective hospitalization (from time of initial cancer diagnosis up to June 1, 2020) | 2.00 (1.62–2.48)    | <0.0001 |
| Metastatic cancer stage (at diagnosis)                | 2.00 (1.41–2.82)    | 0.0001  |

**Conclusion**

To our knowledge, this is the first large population-based study to describe primary care utilization for patients
with newly diagnosed cancer during the COVID-19 pan
demic. We found that there was a sizeable shift in outpa
tient care from in-person to virtual, for both PCPs and
specialists. There was no change in the ability of patients
to visit their usual PCP during the pandemic, albeit in a
different method. No difference was seen in downstream
clinical outcomes such as obtaining prescriptions for common primary care medications and reassuringly,
there was no change in non-elective hospitalizations.
Consent for publication
Not applicable.

Declaration of competing interest
No competing interests to declare.

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