



# VIRTUAL CARE AND EMERGENCY DEPARTMENT VISITS: DATA REPORT

Centre for Digital Health Evaluation  
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Solutions and Virtual Care

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PRESENTED TO:  
ONTARIO MINISTRY OF HEALTH & ONTARIO HEALTH

DATED: MARCH 31, 2022

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# Acronyms

**CCI** Canadian Classification of Health Interventions

**CDHE** Centre for Digital Health Evaluation

**CHF** Congestive Heart Failure

**COPD** Chronic Obstructive Pulmonary Disease

**ED** Emergency Department

**ICES** Institute for Clinical Evaluative Sciences

**OHIP** Ontario Health Insurance Plan

**OP** Outpatient

**OTN** Ontario Telemedicine Network

**WIHV** Women's College Hospital Institute for Health System Solutions and Virtual Care

# Operational Definitions

**Virtual visit:** Outpatient visit delivered via telephone or video modalities

**Canadian Triage and Acuity Scale (CTAS) 4 or 5:** Less Urgent and Non-Urgent emergency department admissions

**Ontario Marginalization Index:** A deprivation-based index focused on factors that undermine individual and area health. The Ontario Marginalization Index combines a wide range of demographic indicators into four distinct dimensions of marginalization: residential instability, material deprivation, dependency, and ethnic concentration.

# Executive Summary

The Centre of Digital Health Evaluation (CDHE) was commissioned by the Ministry of Health (MOH) to investigate the association between virtual care and subsequent emergency department use during COVID-19 using health administrative data.

## Objectives

The objectives of this study were to:

1. Describe the characteristics of patients who had an emergency department (ED) visit within 7 days of a virtual visit.
2. Compare the characteristics of the outpatient visits (virtual versus in-person) that preceded an emergency department visit within 7 days.
3. Describe the characteristics of physicians who saw a patient within 7 days prior to an ED admission.

## Methodology

We used linked and encoded population-based health databases from the Institute for Clinical Evaluative Sciences (ICES) containing population demographics, disease diagnoses, physician services, inpatient hospitalizations, emergency department (ED) visits, and other healthcare service use to examine the characteristics of patients who were admitted to an emergency department between July 1 and September 30, 2021, compared to those admitted over the same period in 2019. We classified patients into different groups depending on whether they had any outpatient visits within the 7 days before their admissions, and whether these outpatient visits were virtual or not. Various subgroups of patients were further identified based on the length of time between their virtual visit and their subsequent ED visit (24h, 48h, 72h, 7d). Finally, we characterized each group of patients based on sociodemographic and some clinical variables and described the characteristics of their most recent outpatient visit before their ED admission as well as the physicians who saw these patients at the aforementioned outpatient visit. All Ontario residents with valid Ontario Health Insurance Plan (OHIP) healthcare coverage were included in the analysis.

## Key Findings

- 1. There was no rise in ED admission volumes and pre-admission outpatient care compared to the pre-COVID period.** While outpatient care transitioned from mainly in-person to a mix of virtual and in-person, the number of ED admissions in 2021 was very similar to that in 2019 (1,080,334 vs. 1,113,230). The overall volume of patients going into the ED with an outpatient visit (about 25%) and the number of outpatient visits before ED admissions (1.3 visits in the 7 days prior) remained the same.
- 2. Patients seen virtually before ED admission had better access to care in the year prior.** Patients who had virtual visits in the week before ED admission had more outpatient visits (virtual or in-person) in the year ahead of their ED admission (19 vs. 11 visits/year).
- 3. Patients seen virtually before ED were appropriately triaged to an ED.** Patients who went to the ED after a virtual visit were more likely to be hospitalized (12% vs 9% and 8% of those with no prior virtual visits (with or without an in-person visit) and those with no virtual or in-person visits in the prior week respectively), suggesting that the virtual visit helped flag higher risk patients who needed hospitalization.
- 4. Various outpatient visit modalities can lead directly to ED admission (the virtual to in-person to ED care pathway is not always necessary).** For many providers, a virtual visit was sufficient to decide to send a patient to the ED, based on similar percentages of patients having had virtual visits to those having had an in-person visit.
- 5. Rural patients and those in the North region have less access to care and this includes virtual care, which may contribute to inappropriate ED visits.** Poor access to virtual care constitutes a missed opportunity to use virtual care to divert patients who don't need emergency care away from the ED.
- 6. Chronic disease patients who visit the ED have good access to virtual care.** Patients with hypertension, asthma, and diabetes had frequent admissions to ED and they were more likely to have had access to virtual care the week before their admission.
- 7. Health administrative data on income and marginalization does not suggest different access to virtual care prior to ED admission, so individual level data needs to be explored.**
- 8. Most patients went straight to the ED without receiving any virtual or in-person care beforehand (75% of patients in 2021 and 74% of patients in 2019) and many of those visits could have been addressed virtually.** For example, urinary tract infections

constitute 9% of all admissions without prior visits, most of which could be addressed virtually.

# 1. Background

The COVID-19 pandemic has led to the rapid virtualization of healthcare in Ontario and across Canada. A research question of particular interest is the relationship between virtual care use and subsequent emergency department visits. Smaller studies have focused on the effect of targeted virtual care programs on emergency department use in their enrolled patients, with mixed results<sup>1,2</sup>. Other studies have found that virtual care reduced COVID-related emergency department visits during the pandemic by serving as a way to triage patients and treat them remotely during times of resource scarcity and physical distancing<sup>3</sup>. However, as the province steps into a post-pandemic recovery period, virtual care is no longer just a necessary substitution for in-person visits but rather another avenue for healthcare delivery moving forward. As a result, there are concerns regarding the usage of virtual care in the long-term and its overall impact on quality of patient care. It is unclear whether virtual visits, compared to in-person visits, increase emergency department use for reasons such as physicians being unable to physically examine their patients leading to missed diagnoses or the like. To our knowledge, there is limited literature that delves into this issue. Findings from this study will help to inform the development of Guidelines for Clinically Appropriate Use of Virtual Care.

## Purpose and Objectives:

The purpose of the overall report is to investigate the association between virtual care use and subsequent emergency department use during a relatively stable period of COVID-19, outside the initial waves, at a population-level.

This report focuses on examining the characteristics of patients who visited an emergency department (ED) between July 1 and September 30, 2021 relative to the same period in 2019 and explores the healthcare utilization of these patients during the week preceding their admission. With this goal in mind, we have 3 specific objectives:

1. Describe the characteristics of patients who had an emergency department (ED) visit within 7 days of a virtual visit.

2. Compare the characteristics of the outpatient visits (virtual versus in-person) that preceded an emergency department visit within 7 days of ED admission.
3. Describe the characteristics of physicians who saw a patient within 7 days prior to an ED admission.

## 2. Methodology

Various ICES health administrative databases pertaining to population demographics, healthcare utilization, and disease diagnoses were used in this study. A full list of databases used in this analysis can be found in Table 1 of the Appendix. 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 (REB). Databases were linked using unique identifiers and analyzed at ICES.

### Objective 1 Methods

To address Objective 1, we used a retrospective study design to identify all patients who had an emergency department (ED) visit between July 1 and September 30, 2021. This period was chosen as it fell during a relatively stable period of COVID-19, outside the initial waves. The population of interest consisted of all Ontario residents who were eligible for OHIP during the study window. We applied the following exclusion criteria to the cohort: invalid health card number, non-Ontario resident, missing key demographic identifiers (e.g., birth date, sex), and we also excluded those who had another ED admission within 7 days prior to the start of the study window.

Patients were further categorized into subgroups (Table 1) based on the length of time between their ED admission and the most recent virtual visit that occurred before their ED admission (patients could have belonged to more than one subgroup, i.e. patients in the 48 hours group include patients in the 24 hours group).

Virtual visits were identified as any OHIP claim with the location recorded as "P" for phone, indicating virtual/telemedicine services (both video and phone were covered under this location code). We repeated the above analysis for a pre-pandemic comparison period (July to September 2019), and we also ran a separate analysis limiting ED admissions to those classified as Canadian Triage and Acuity Scale (CTAS) 4 or 5 (Less Urgent and Non-Urgent admissions).

**Table 1: Breakdown of patient groups**

<b>Patient Groups</b>
All patients with an ED admission during the study window
Patients with an ED admission who did not have any virtual visits within the 7 days prior (but who may have had in-person visits)
Patients with an ED admission who did not have any visits (virtual or in-person) within the 7 days prior
Patients who had at least one virtual visit within 24 hours prior to an ED admission
Patients who had at least one virtual visit within 48 hours prior to an ED admission
Patients who had at least one virtual visit within 72 hours prior to an ED admission
Patients who had at least one virtual visit within 7 days prior to an ED admission
Patients who only had an in-person outpatient visit (with any physician specialty) within 7d prior to ED visit

Note: patients could have belonged to more than one subgroup, i.e. patients in the 48 hours group include patients in the 24 hours group

## Objective 2 Methods

To address Objective 2, we included patients with an ED admission between July and September of 2019 or 2021 (i.e. all patients identified in Objective 1) and selected their most recent virtual visit or in-person visit that occurred within 7 days prior to their ED admission.

We then divided these outpatient visits into four subgroups:

1. **Any visits** (virtual or in-person) **during** the pandemic period (July-Sept 2021)
2. **Virtual visits during** the pandemic period (July-Sept 2021)
3. **In-person visits during** the pandemic period (July-Sept 2021)
4. **In-person visits before** the pandemic period (July-Sept 2019)

We further repeated the above analyses for only ED admissions classified as Less or Non-Urgent. Table 3 in the Appendix lists outpatient visit characteristics that were extracted.

## Objective 3 Methods

To address Objective 3, we created a cohort of all unique physicians who saw a patient with an outpatient visit that was followed by an ED admission within 7 days, between July and



September of 2019 or 2021 (i.e. all the patients identified in Objective 1). Only the physician seen in the outpatient visit that was closest in time to the patient's ED admission was selected. Three individual physician cohorts were created based on the following criteria:

1. **Physicians who saw a patient with a virtual visit** that was followed by an ED admission within 7 days (Jul-Sep **2021**)
2. **Physicians who saw a patient with a virtual or in-person visit** that was followed by an ED admission (Jul-Sep **2021**)
3. **Physicians who saw a patient with a virtual or in-person visit** that was followed by an ED admission (Jul-Sep **2019**)

Physicians in each of these cohorts were further categorized based on their medical specialty (e.g., primary care). We also repeated the above analyses for ED admissions that were classified as less or non-urgent. Table 4 in the Appendix summarizes the physician characteristics that were extracted for each subgroup of interest.

## 3. Results

### Emergency Department Visits

#### All ED Admissions

**Between July 1, 2021 and September 30, 2021**, there were 1,080,334 ED admissions in Ontario and 74% of these visits had no prior outpatient visits within 7 days of admission. Furthermore, 14% of patients admitted had at least one virtual visit within the 7 days prior to ED admission occurring on average 2.25 (SD=2.31) days before the ED admission. Among those who had a virtual visit within 7 days of ED admission, 34% had a virtual visit on the same day as the ED admission. Among patient who had an in-person visit only within the last 7 days prior to admission, 34% had an in-person visit the same day of admission. In comparison, **between July 1, 2019 and September 30, 2019**, there were 1,113,230 ED admissions and 75% of admissions had no prior outpatient visits (virtual or in-person) with 7 days of admission and only 0.7% of admissions had a virtual visit 7 days prior to ED admission.

The most common reasons for ED admission in 2021 were **chest pain** (14%), followed by unspecified **abdominal pain** (11%), and **urinary tract infection (UTI)** (9%) (Table 2).

Among patients with prior virtual visits within 7 days of ED admission, the same conditions were most common but with slightly higher frequencies (chest pain -18%, abdominal pain -

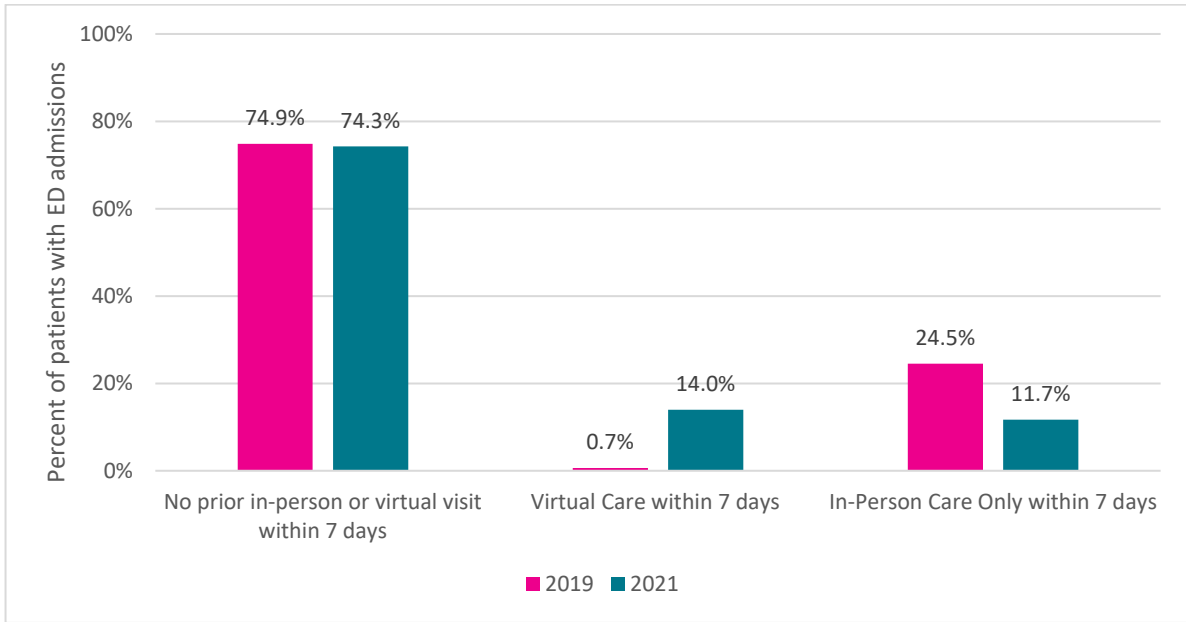
13% and UTI - 9%). Among patients with an in-person visit only prior to ED admission (11.7% of all admissions), the top reasons for admission were also the same (chest pain - 15%, abdominal pain -13% and UTI - 10%). The top reasons for admission during the control period in 2019 were similar: chest pain (12%), abdominal pain (11%) and UTI (10%). The most common reasons for virtual visits in 2021 were unspecified - 12%, gastrointestinal issues - 12% and anxiety - 11% (Table 3).

### **Less or Non-Urgent ED Admissions**

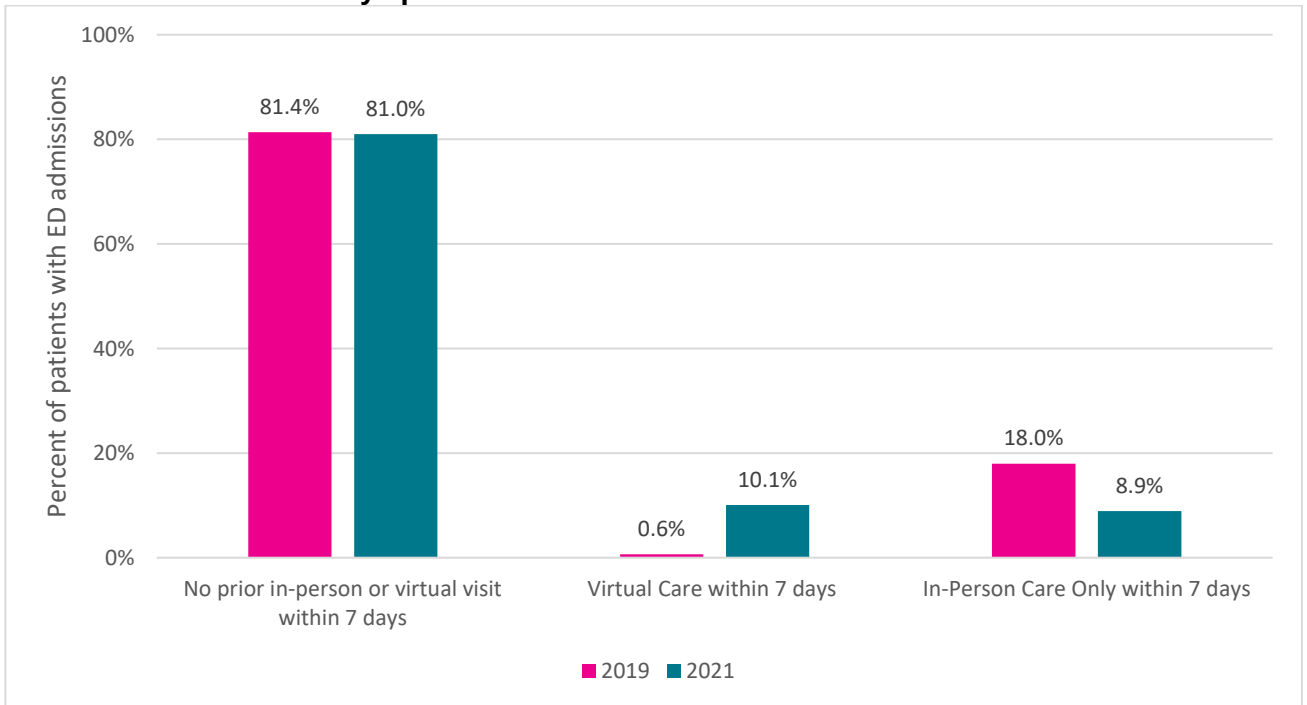
**Between July 1, 2021 and September 30, 2021**, there were 295,197 **less or non-urgent ED admissions** in Ontario and 81% of these visits had no prior outpatient visits within 7 days of admission. Furthermore, 10% of patients admitted had at least one virtual visit within the 7 days prior to ED admission occurring on average 2.29 (SD=2.30) days before the ED admission. Among those who had a virtual visit within 7 days of ED admission, 32% had a virtual visit on the same day as the ED admission. Among those who only had an in-person visit within 7 days of ED admission (9% of all patients with less and non-urgent admission), 33% had an in-person visit on the same day as the ED admission. In comparison, **between July 1, 2019 and September 30, 2019**, there were 334,036 ED admissions of which 81% had no prior outpatient visits with 7 days of admission and only 0.6% had a virtual visit 7 days prior to ED admission, while 18% had only in-person visits.

About a third of all ED admissions consisted of admissions for non-urgent or less urgent care (27% in 2021 and 30% in 2019). We did not observe any striking differences between all ED admissions and less or non-urgent ED admissions. As a result, we have included most tables and graphs limiting data to less and non-urgent care in Appendix 3.

**Figure 1. Percentage of patients admitted to ED between July 1 and Sep 30 in 2019 (n=1,113,230) and 2021 (n=1,080,334) who had no outpatient visits in the 7 days prior and those who had virtual visits within 7 days and those that had only in-person visits within the 7 days prior to admission.**



**Figure 2. Percentage of patients with less or non-urgent ED admissions between July 1 and Sep 30 in 2019 (n=334,036) and 2021 (n=295,197) who had no outpatient visits in the 7 days prior and those who had virtual visits within 7 days and those that had only in-person visits within the 7 days prior to admission.**



**Table 2: Top 5 Reasons for ED admission, N (%), July 1, 2021- September 30, 2021**

	All patients	No prior virtual visits	No prior visits (virtual or in-person)	Virtual Visits within 24 hours	Virtual Visits within 48 hours	Virtual Visits within 72 hours	Virtual Visits within 7 days	In-person Visits only within 7 days
	N=1,080,334	N=929,179	N=802,433	N=76,027	N=92,749	N=106,801	N=151,155	N=126,746
<b>Chest pain</b>	38,183 (14.1%)	31,859 (13.8%)	27,735 (13.6%)	3,321 (15.7%)	3,964 (15.6%)	4,497 (15.5%)	6,324 (15.8%)	4,124 (15.1%)
<b>Abdominal pain</b>	29,859 (11.0%)	24,688 (10.7%)	21,029 (10.3%)	2,480 (11.8%)	3,066 (12.1%)	3,536 (12.2%)	5,171 (12.9%)	3,659 (13.4%)
<b>Urinary tract infection</b>	25,309 (9.3%)	21,648 (9.3%)	18,981 (9.3%)	1,736 (8.2%)	2,176 (8.6%)	2,591 (9.0%)	3,661 (9.1%)	2,667 (9.8%)
<b>Acute upper respiratory infection</b>	15,235 (5.6%)	13,063 (5.6%)	12,004 (5.9%)	1,429 (6.8%)	1,646 (6.5%)	1,797 (6.2%)	2,172 (5.4%)	1,059 (3.9%)
<b>Open wound of finger(s)</b>	14,781 (5.4%)	14,035 (6.1%)	13,181 (6.5%)	272 (1.3%)	345 (1.4%)	439 (1.5%)	746 (1.9%)	854 (3.1%)

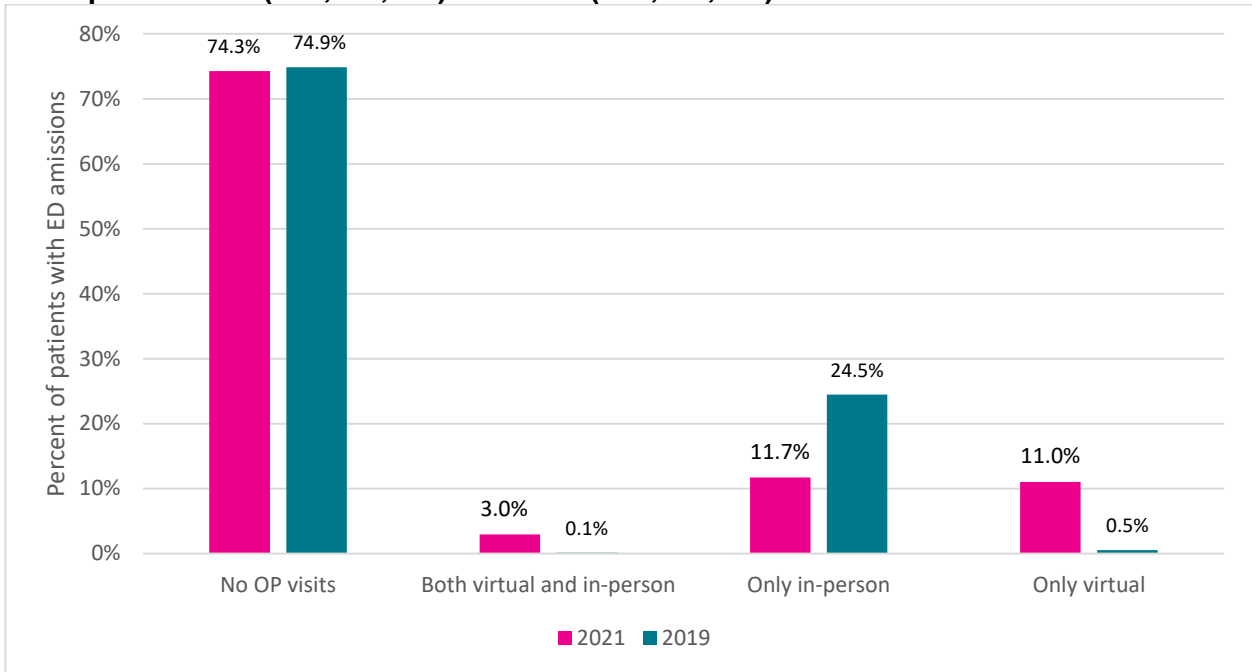
Note: Top 20 reasons for ED admissions in 2021 can be found in Appendix 2

**Table 3: Top 5 reasons for the last virtual visit (or in-person for the in-person only group) prior to ED admission, N (%), July 1, 2021- September 30, 2021**

	All patients	Virtual Visits within 24 hours	Virtual Visits within 48 hours	Virtual Visits within 72 hours	Virtual Visits within 7 days	In-person Visits only within 7 days
	N=1,080,334	N=76,027	N=92,749	N=106,801	N=151,155	N=126,746
<b>Other ill-defined conditions</b>	8,926 (11.6%)	4,961 (12.2%)	5,935 (12.1%)	6,635 (11.9%)	8,926 (11.6%)	4,601 (9.43%)
<b>Gastrointestinal issues</b>	8,880 (11.6%)	5,634 (13.9%)	6,444 (13.1%)	7,060 (12.6%)	8,880 (11.6%)	6,522 (13.36%)
<b>Anxiety</b>	8,263 (10.8%)	2,921 (7.2%)	3,968 (8.1%)	4,941 (8.8%)	8,263 (10.8%)	6,285 (12.88%)
<b>Chest pain</b>	5,787 (7.5%)	4,086 (10.1%)	4,506 (9.2%)	4,832 (8.7%)	5,787 (7.5%)	4,008 (8.21%)
<b>Leg cramps</b>	5,178 (6.8%)	2,755 (6.8%)	3,313 (6.8%)	3,774 (6.8%)	5,178 (6.8%)	3,723 (7.63%)

Note: Top 20 reasons for virtual visits prior to ED admissions in 2021 can be found in Appendix 2.

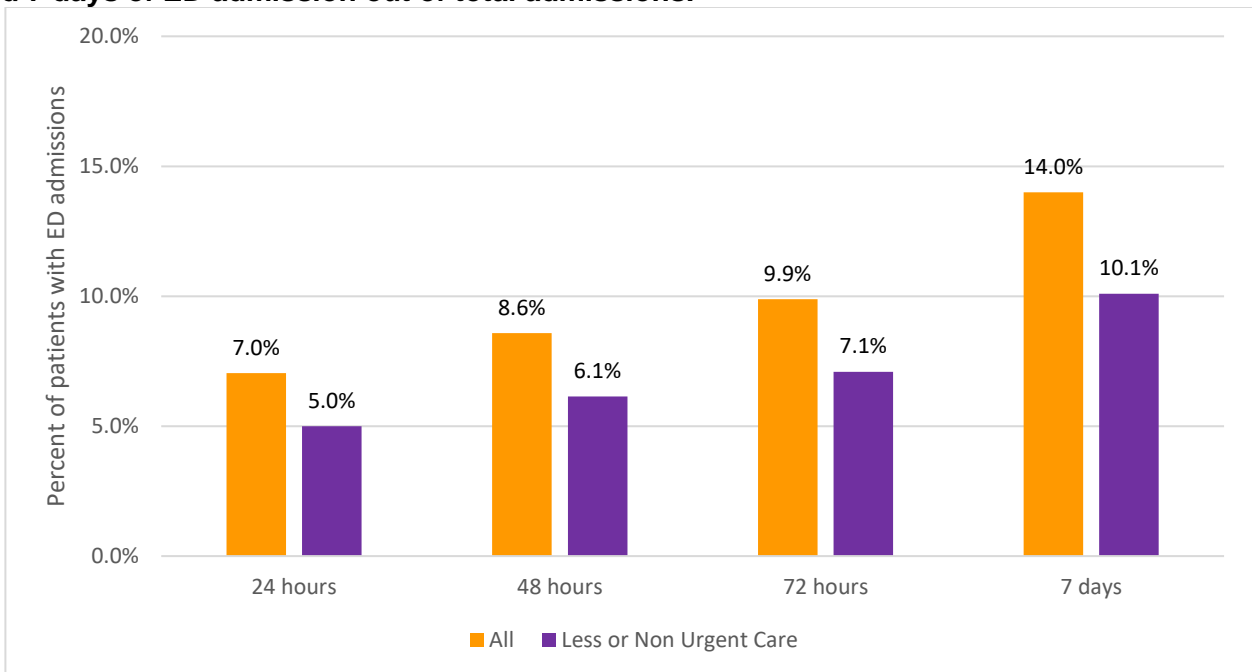
**Figure 3. Mode of Outpatient (OP) Visits in the 7 days prior to ED admission between July 1 and Sep 30 in 2019 (n=1,113,230) and 2021 (n=1,080,334)**



**Table 4: Mean number of outpatient visits in the 7 days before ED admission, Mean (SD)**

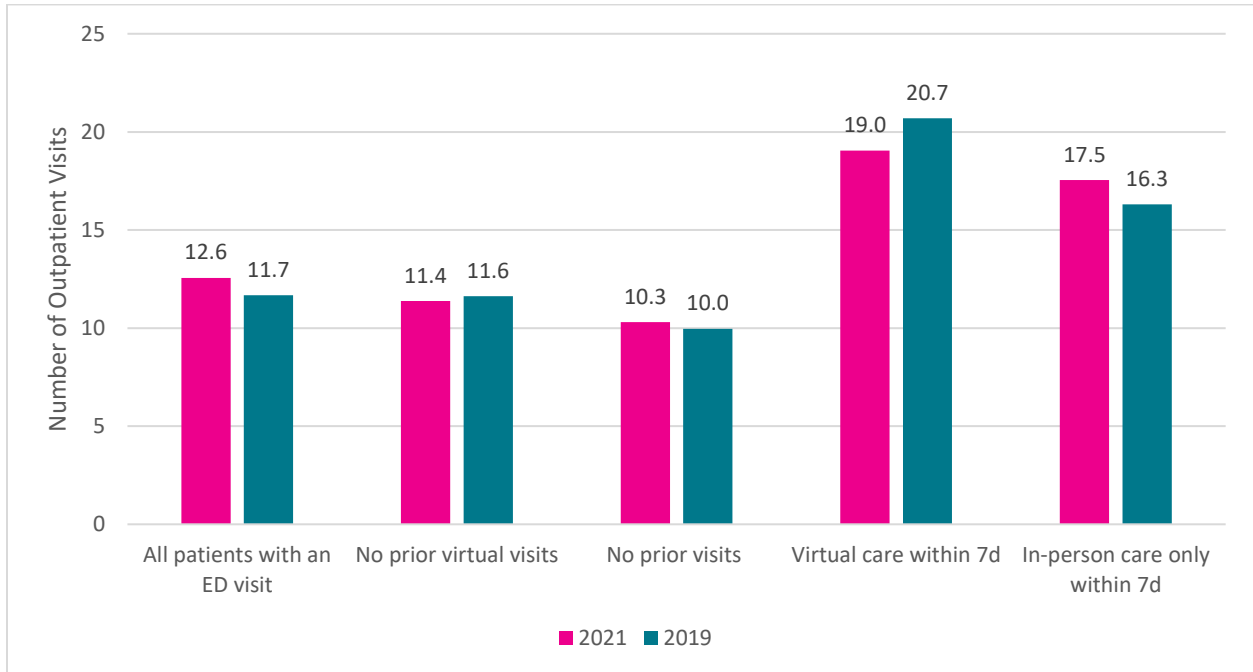
	All patients	No Prior Virtual Visits	24hr	48hr	72hr	7d	In-person only 7d
<b>2021</b>	1.32 ± 0.65	1.17 ± 0.46	1.52 ± 0.82	1.51 ± 0.81	1.50 ± 0.80	1.45 ± 0.76	1.17 ± 0.46
<b>2019</b>	1.25 ± 0.56	1.25 ± 0.56	1.35 ± 0.70	1.35 ± 0.70	1.35 ± 0.70	1.34 ± 0.68	1.53 ± 1.18

**Figure 4. Percentage of patients with a virtual visit within 24 hours, 48 hours, 72 hours, and 7 days of ED admission out of total admissions.**

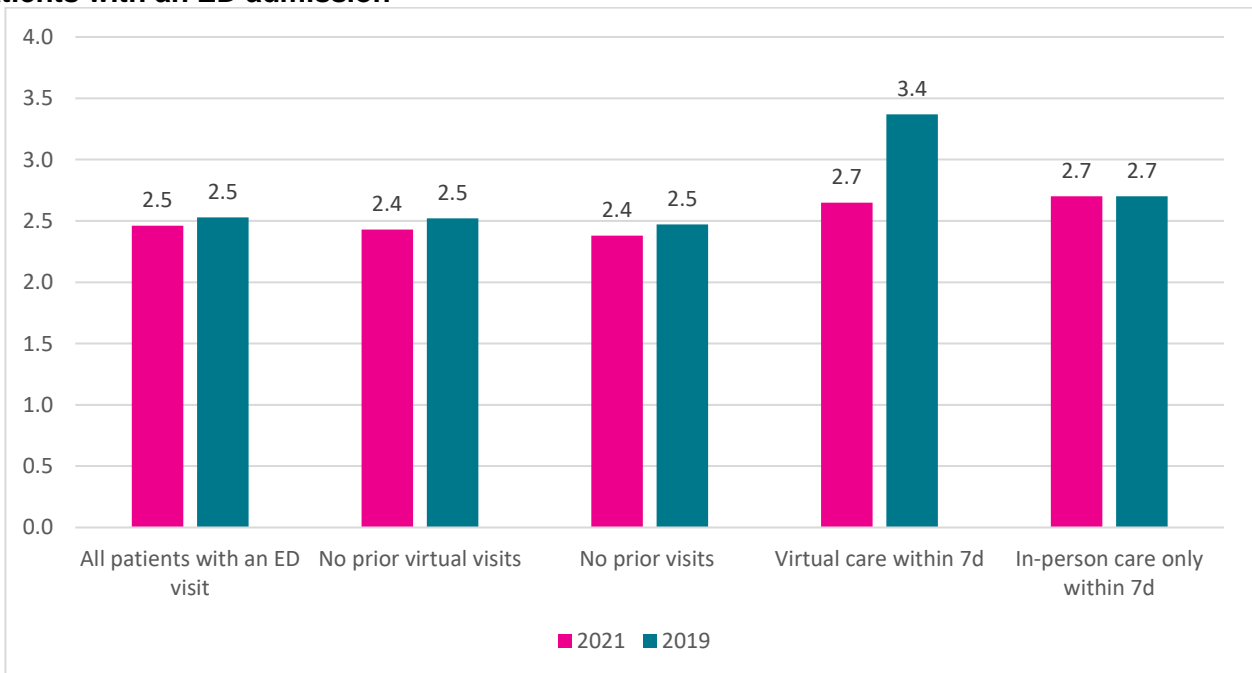


Note: Groups are additive; 7 days group contains all other groups

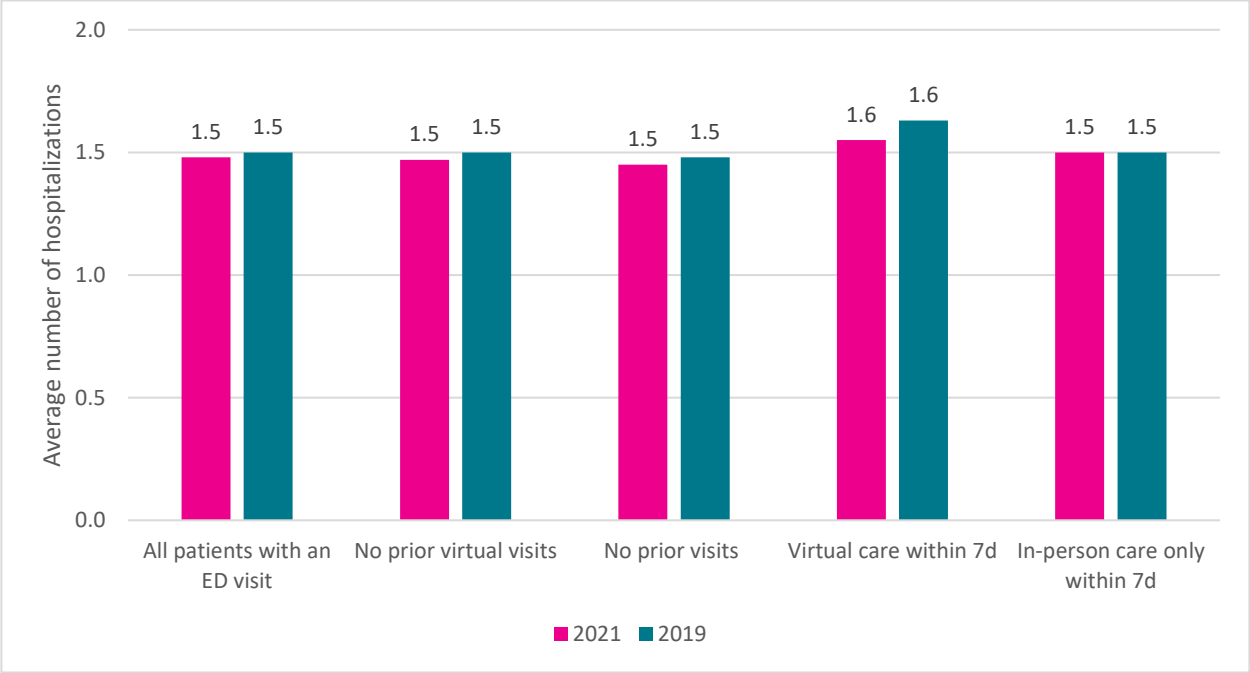
**Figure 5. Average number of Outpatient Visits in the past year among subgroups of patients with an ED admission**



**Figure 6. Average number of ED Admissions in the past year among subgroups of patients with an ED admission**



**Figure 7. Average number of hospitalizations in the past year among subgroups of patients with an ED admission**



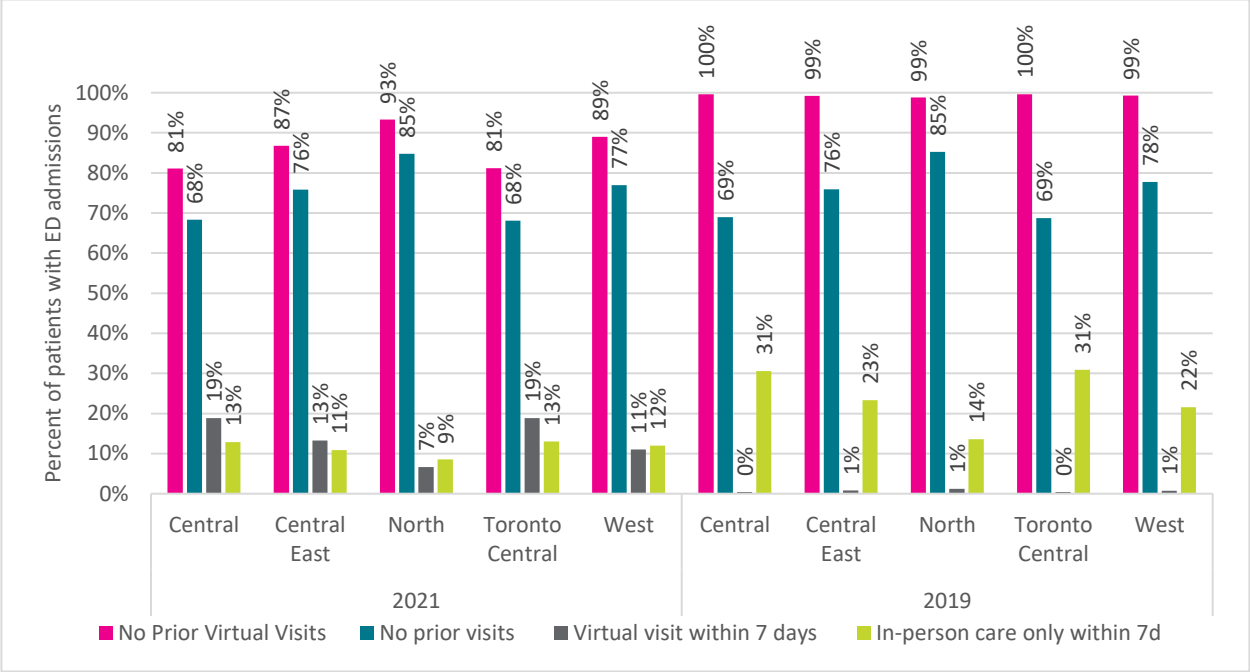
## EMERGENCY DEPARTMENT VISITS SUMMARY

- Approximately 3 in 4 people (74%) visited the ED without any prior visits (in-patient or virtual) in 2021. This was nearly the same as that seen in 2019.
- While volumes of patients going to ED with outpatient visits within the week before admission were similar in 2019 and 2021, the modality of the outpatient visits shifted. Patients in 2021 were about equally likely to have had a virtual or an in-person visit ahead of their ED admission. This means that there was no change in patient behaviour ahead of ED admissions and access to virtual care did not lead to more patients using outpatient care ahead of admission.
- The percentage of people coming into ED with a prior virtual care visit (as opposed to in-person visit) within the last seven days increased (14% in 2021 vs. 0.7% in 2019), which is expected given the increase in virtual care use in 2021 relative to 2019.
- The number of outpatient visits in the seven days prior to admission also did not change (1.3 in 2021 vs. 1.25 in 2019), suggesting that patients had not transitioned from having an in-person visit to having both virtual and an in-person care prior to ED admission.
- Patients in 2021 and 2019 had similar number of outpatient visits in the year ahead of their ED admission.
- Patients who had a virtual care visit within seven days of their ED admission had a higher number of outpatient visits (19) in the year leading to their ED admission than those without virtual visits (11). No such effect was observed for hospitalizations or ED admissions in the year prior to admission, suggesting that patients had better access to outpatient care through virtual care, rather than being more severely ill.
- The top reasons for ED admission were chest pain, abdominal pain, and urinary tract infections, while the top reasons for the outpatient visit before ED admission were gastrointestinal issues, anxiety, and chest pain (outside of an undefined category). These conditions did not vary much regardless of whether the visits were virtual or in-person.

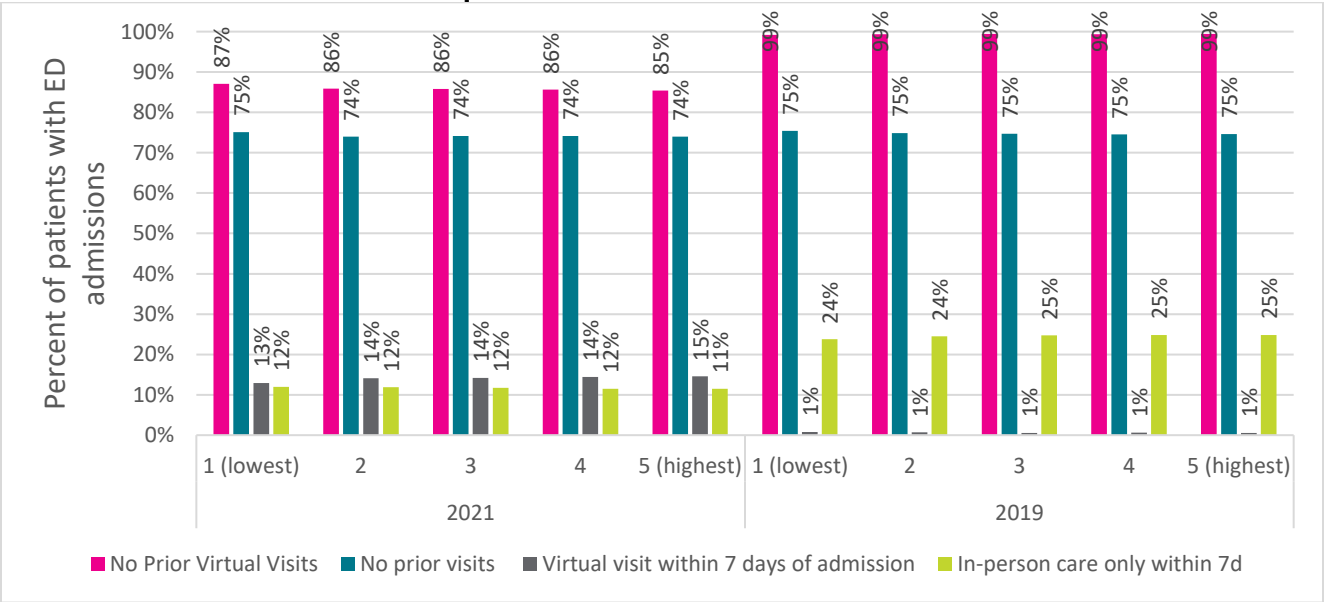


# Patient Characteristics

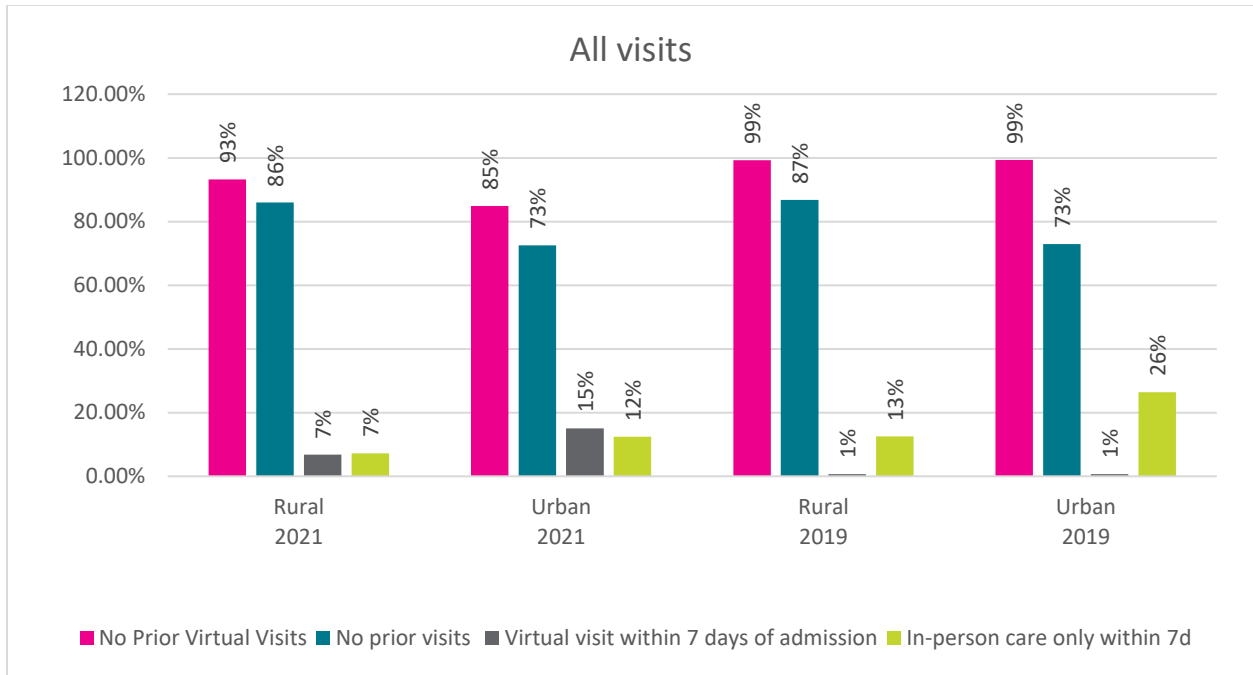
**Figure 8. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person), with virtual visit(s), or with in-person visits only within 7 days prior to ED admission across Ontario regions.**



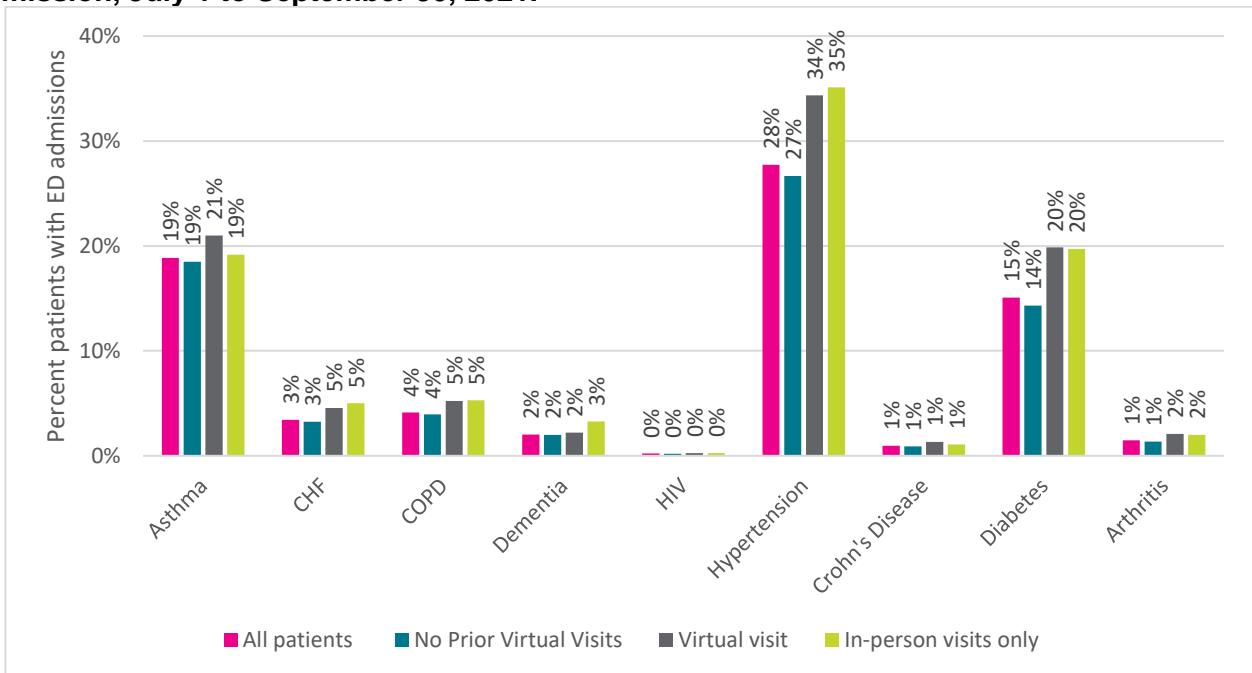
**Figure 9. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person), with virtual visit(s), or with in-person visits only within 7 days prior to ED admission across income quintiles.**



**Figure 10. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person), with virtual visit(s), or with in-person visits only within 7 days prior to ED admission in rural vs. urban areas.**



**Figure 11. Percentage of patients out of total patients with ED admissions who had pre-existing conditions across varying use of virtual care in the 7 days prior to their ED admission, July 1 to September 30, 2021.**



**Table 5: Ontario Marginalization Index scores among patients with an ED admission**

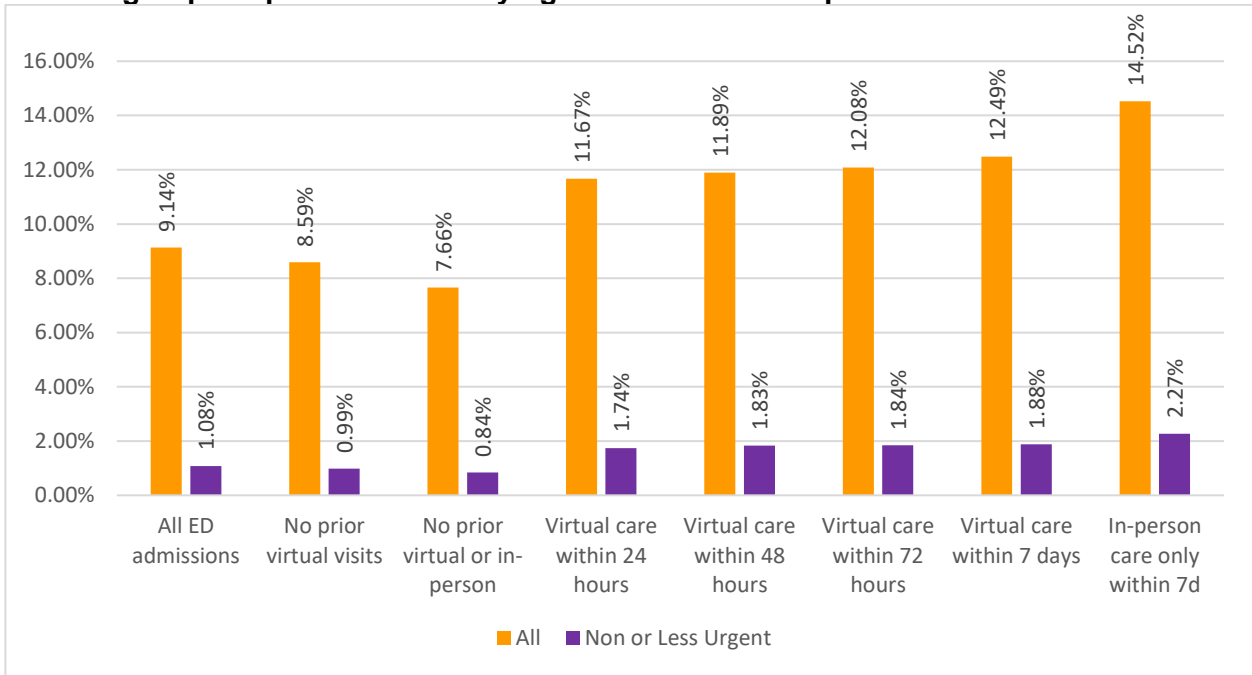
		All patients	No Prior Virtual Visits	No prior visits	24hr	48hr	72hr	7d	In-person visits only within 7d
Dependency, Mean (SD)	2021	2.95 ± 1.48	2.98 ± 1.48	2.99 ± 1.48	2.69 ± 1.47	2.71 ± 1.47	2.73 ± 1.47	2.77 ± 1.48	2.91 ± 1.49
	2019	2.97 ± 1.48	2.97 ± 1.48	3.02 ± 1.48	3.23 ± 1.44	3.23 ± 1.44	3.24 ± 1.44	3.26 ± 1.44	2.83 ± 1.48
Material deprivation, Mean (SD)	2021	3.04 ± 1.43	3.06 ± 1.43	3.06 ± 1.43	2.90 ± 1.43	2.91 ± 1.43	2.92 ± 1.43	2.94 ± 1.44	3.04 ± 1.44
	2019	3.09 ± 1.43	3.09 ± 1.43	3.11 ± 1.43	3.26 ± 1.42	3.29 ± 1.42	3.30 ± 1.41	3.35 ± 1.40	3.02 ± 1.44
Residential instability, Mean (SD)	2021	3.13 ± 1.43	3.13 ± 1.42	3.13 ± 1.42	3.03 ± 1.51	3.04 ± 1.50	3.05 ± 1.50	3.09 ± 1.49	3.16 ± 1.46
	2019	3.14 ± 1.43	3.14 ± 1.43	3.14 ± 1.41	3.31 ± 1.36	3.33 ± 1.36	3.33 ± 1.35	3.37 ± 1.35	3.13 ± 1.48
Ethnic concentration, Mean (SD)	2021	3.05 ± 1.47	2.99 ± 1.46	2.94 ± 1.46	3.55 ± 1.38	3.53 ± 1.39	3.51 ± 1.39	3.45 ± 1.41	3.26 ± 1.44
	2019	3.04 ± 1.47	3.05 ± 1.47	2.93 ± 1.47	2.64 ± 1.35	2.64 ± 1.36	2.64 ± 1.35	2.62 ± 1.35	3.40 ± 1.43

## PATIENT CHARACTERISTICS SUMMARY

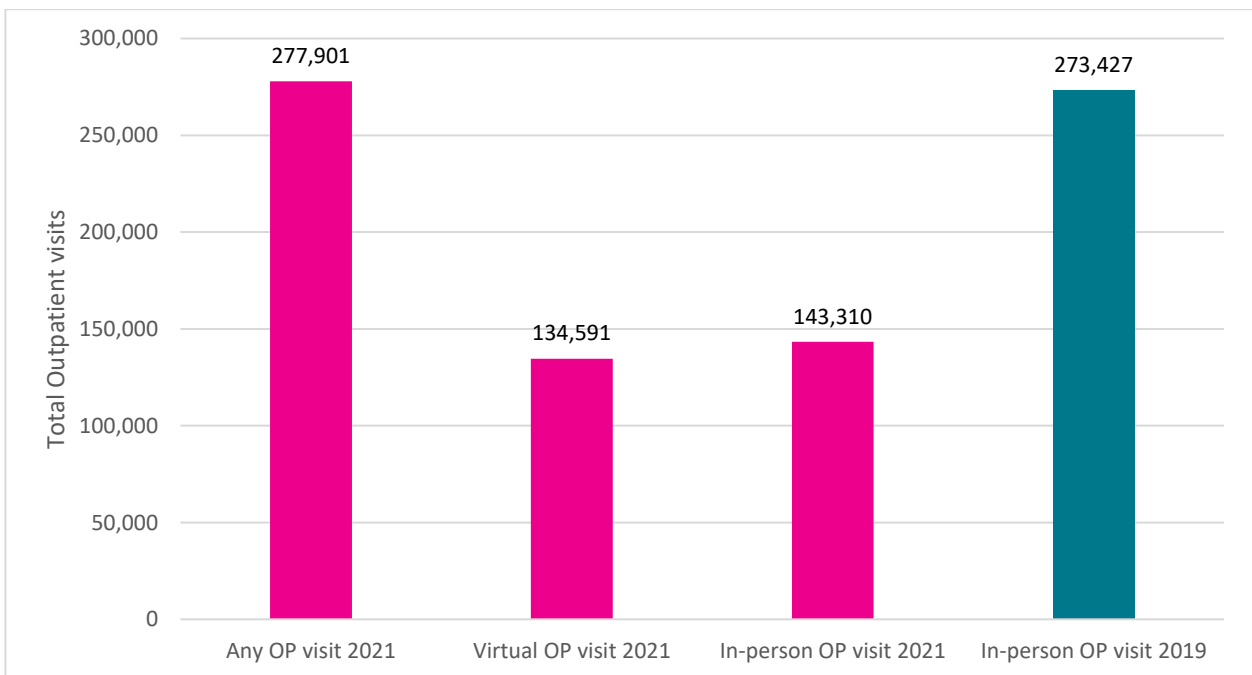
- Most patients had no prior visit at all (virtual or in-person) within 7d of their ED admission. There was a consistently higher percentage of patients with a prior virtual visit in 2021 than 2019 due to the widespread use of virtual care in 2021.
- The highest percent of patients with a virtual visit within a week of admission was in the Central and Toronto Central regions (~19% in 2021) and the lowest was in the North (~7%), perhaps suggesting a missed opportunity for virtual care in this region.
- The proportion of patients across income quintiles for both 2019 and 2021 was similar irrespective of virtual use the week before. In 2021, 74% had no prior visits at all, 86% had no prior virtual visit, and 13% had a virtual visit across all income levels. This suggests no significant gaps in virtual care access based on income level.
- More urban patients had a virtual visit within the week before their ED admission than rural patients in 2021 (15% vs 7%), which also suggests a potential missed opportunity for virtual care use in rural areas.
- Among all patients with an ED admission, patients with hypertension (28%), asthma (19%), and diabetes (15%) had a higher percent of admissions. The same groups had the highest percent admissions among patients with a virtual visit the week before their ED, (34%, 21% and 20%, respectively). Across all chronic disease patient groups, there were more patients with a virtual visit within 7d of an ED admission than without. This data suggests that chronic condition patients may have better access to virtual care.
- No significant differences in dimension of marginalization scores were found across the various patient subgroups, suggesting equitable access to care at the population level.

## Visit Characteristics

**Figure 12. Percentage of patients with ED admissions that resulted in hospitalization across subgroups of patients with varying use of virtual care prior to admission in 2021.**



**Figure 13. Total Outpatient visits occurring within 7 days of an ED admission.**



**Table 6: Characteristics of the most recent outpatient visits that occurred within 7 days of all ED admissions.**

	Any OP visit 2021	Virtual OP visit 2021	In-person OP visit 2021	In-person OP visit 2019
	N=277,901	N=134,591	N=143,310	N=273,427
<b>Type of visit, N (%)</b>				
Initial	253,278 (91.1%)	119,614 (88.9%)	133,664 (93.3%)	258,508 (94.5%)
Urgent follow-up	24,623 (8.9%)	14,977 (11.1%)	9,646 (6.7%)	14,919 (5.5%)
<b>Number of days between OP and ED visit, mean (SD)</b>	2.06 ± 2.28	2.09 ± 2.26	2.03 ± 2.30	2.17 ± 2.31
<b>OP visit same day as ED visit, N (%)</b>	109,937 (39.6%)	49,908 (37.1%)	60,029 (41.9%)	102,150 (37.4%)
<b>OP visit preceded by another within 7d, N (%)</b>	88,742 (31.9%)	44,491 (33.1%)	44,251 (30.9%)	75,390 (27.6%)
<b>Virtual visit code, N (%)</b>				
No virtual visit	143,310 (51.6%)	0 (0.0%)	143,310 (100.0%)	273,427 (100.0%)
Virtual visit - B code	6,120 (2.2%)	6,120 (4.6%)	--	--
Virtual visit - K code	128,471 (46.2%)	128,471 (95.5%)	--	--

**Table 7: Top 5 reasons for most recent outpatient visit that occurred within 7d prior to ED admissions**

	Any OP visit 2021	Virtual OP visit 2021	In-person OP visit 2021	In-person OP visit 2019
	N=277,901	N=134,591	N=143,310	N=273,427
Gastrointestinal Problems	15,883 (12.7%)	8,040 (11.9%)	7,843 (13.6%)	16,328 (13.6%)
Anxiety	14,638 (11.7%)	7,119 (10.5%)	7,519 (13.0%)	12,740 (10.6%)
Other	13,120 (10.5%)	7,901 (11.6%)	5,219 (9.0%)	9,892 (8.3%)
Chest pain	10,082 (8.0%)	5,323 (7.8%)	4,759 (8.2%)	9,022 (7.5%)
Leg pain and cramps	8,687 (6.9%)	4,620 (6.8%)	4,067 (7.0%)	8,370 (7.0%)

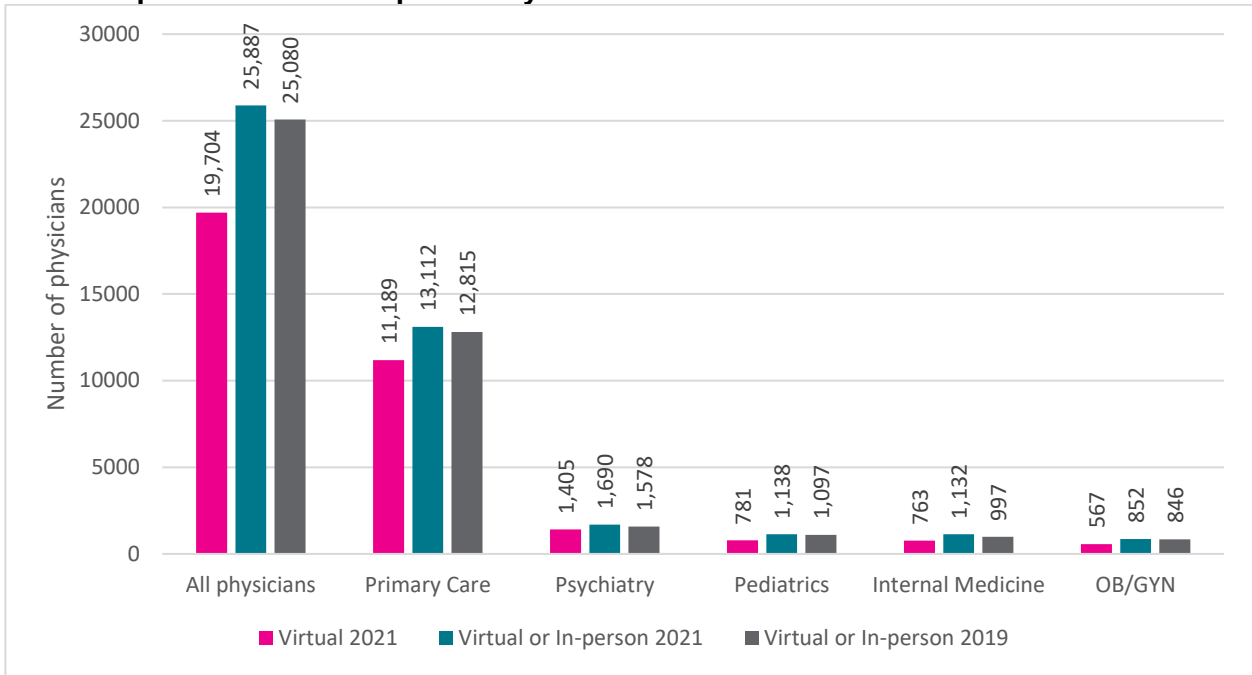
Note: Full list of top 20 reasons for outpatient visit can be found in the Appendix.

## VISIT CHARACTERISTICS SUMMARY

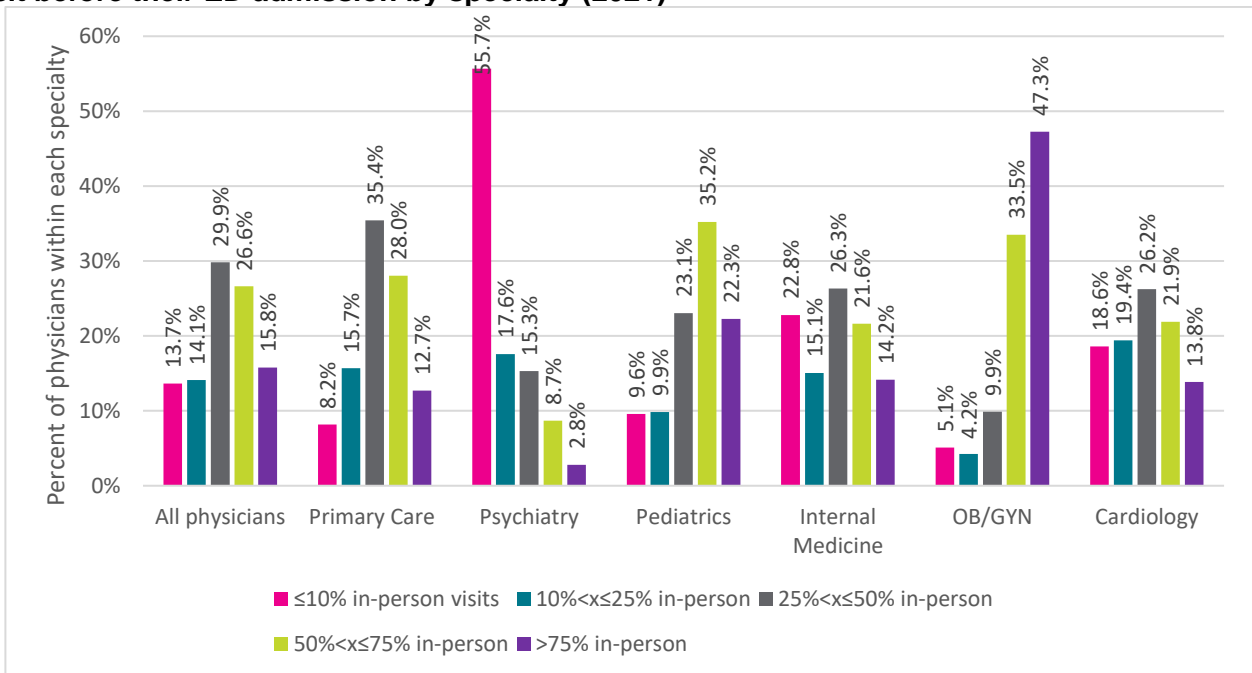
- Patients with ED admissions who had virtual care within the week before admission were more likely to be hospitalized (7.7% vs 12.5% of all vs. those with prior virtual care). This suggests that the patients going to the ED after a virtual care visit were likely more severely ill patients overall, and VC may have been used by their outpatient provider to triage to ED as their problem likely could not be resolved in an outpatient setting. This likely signifies that for many of these patients the ED admission was simply a stop on their way to admission to the hospital.
- The number of outpatient visits occurring in the week before ED admissions was relatively equally split between virtual and in-person care (134,591 virtual vs. 143,310 in-person), consistent with prior knowledge that ambulatory care in Ontario has been relatively equally split between in-person and virtual care.
- Most of the outpatient visits were initial (as opposed to urgent follow-up) (91%).
- It took on average about 2 days between the outpatient visit and the ED admission, and 40% of the outpatient visits occurred on the same day. These trends were very similar across visits, irrespective of whether they were in-person or virtual, with the exception of in-person visits being slightly more likely to occur on the same day as an ED admission (42% of in-person vs. 37% of virtual).
- About a third (32%) of outpatient visits were preceded by another visit. More virtual (33%) than in-person (31%) outpatient visits were preceded by another, which contradicts the assumption that virtual visits need to be followed by an in-person visit ahead of an ED admission.
- The majority (96%) of outpatient visits were billed for with the new temporary virtual care billing codes (K-codes) as opposed to the old video only B-codes.
- The top 5 reasons for the outpatient visit that took place before an ED admission were identical across patients irrespective of whether their care was in-person or virtual.

# Physician Characteristics

**Figure 14. All physicians who saw a patient with an ED admission that was preceded by a virtual or in-person visit in the past 7 days**



**Figure 15. Virtual care practice patterns of physicians who provided patient's last virtual visit before their ED admission by specialty (2021)**



Note: The above general practice patterns display the breakdown of virtual to in-person care provided by each physician across their entire practice over the period of July 1, 2021 to September 30, 2021

**Table 8: Comparison of physicians who provided the last outpatient visit before ED admissions across care modalities (virtual vs. virtual or in-person).**

		All physicians N=19,704	Primary Care physicians only N=11,189	Psychiatry N=1,405	Pediatrics N=781	Internal Medicine N=763	Obstetrics & Gynaecology N=567
<b>Age Mean (SD)</b>							
Virtual Visit	Mean (SD)	49.39 ± 12.51	49.09 ± 12.91	54.05 ± 13.40	50.53 ± 12.67	49.84 ± 13.81	49.31 ± 11.29
Virtual or In-person visit	Mean (SD)	49.33 ± 12.67	48.95 ± 13.00	53.56 ± 13.48	49.87 ± 12.48	48.64 ± 14.02	49.89 ± 11.61
<b>Sex, N (%)</b>							
Virtual Visit	Female	8,920 (45.3%)	5,611 (50.2%)	615 (43.8%)	465 (59.5%)	226 (29.6%)	375 (66.1%)
	Male	10,784 (54.7%)	5,578 (49.9%)	790 (56.2%)	316 (40.5%)	537 (70.4%)	192 (33.9%)
Virtual or In-person visit	Female	11,096 (42.9%)	6,335 (48.3%)	748 (44.3%)	680 (59.8%)	364 (32.2%)	550 (64.6%)
	Male	14,791 (57.1%)	6,777 (51.7%)	942 (55.7%)	458 (40.3%)	768 (67.8%)	302 (35.5%)
<b>Region of practice, N (%)</b>							
Virtual Visit	Missing	122 (0.6%)	80 (0.7%)	11 (0.8%)	7(0.9%)	*1 – 5	*1 – 5
	Central	5,952 (30.2%)	3,574 (31.9%)	283 (20.1%)	272 (34.8%)	220 (28.8%)	159 (28.0%)
	East	4,667 (23.7%)	2,705 (24.2%)	278 (19.8%)	176 (22.5%)	166 (21.8%)	138 (24.3%)
	North	951 (4.8%)	605 (5.4%)	47 (3.4%)	11 (1.4%)	*36 – 40	*23 – 27
	Toronto	3,049 (15.5%)	1,446 (12.9%)	471 (33.5%)	141 (18.1%)	86 (11.3%)	103 (18.2%)
	West	4,963 (25.2%)	2,779 (24.8%)	315 (22.4%)	174 (22.3%)	250 (32.8%)	139 (24.5%)
Virtual or In-person visit	Missing	181 (0.7%)	106 (0.8%)	16 (1.0%)	10 (0.9%)	8 (0.7%)	3 (0.4%)
	Central	7,454 (28.8%)	3,986 (30.4%)	335 (19.8%)	381 (33.5%)	327 (28.9%)	225 (26.4%)
	East	6,268 (24.2%)	3,220 (24.6%)	349 (20.7%)	253 (22.2%)	244 (21.6%)	224 (26.3%)
	North	1,406 (5.4%)	846 (6.5%)	68 (4.0%)	32 (2.8%)	51 (4.5%)	38 (4.5%)
	Toronto	3,917 (15.1%)	1,632 (12.5%)	547 (32.4%)	180 (15.8%)	140 (12.4%)	146 (17.1%)
	West	6,661 (25.7%)	3,322 (25.3%)	375 (22.2%)	282 (24.8%)	362 (32.0%)	216 (25.4%)
<b>Years in practice, mean (SD)</b>							
Virtual Visit	Mean (SD)	22.54 ± 13.71	21.96 ± 14.08	27.20 ± 14.99	24.28 ± 14.06	22.57 ± 15.72	22.68 ± 12.35
Virtual or In-person visit	Mean (SD)	22.41 ± 13.78	21.75 ± 14.14	26.60 ± 15.09	23.45 ± 13.88	21.32 ± 15.92	23.29 ± 12.92
<b>Patient volume during observation window, mean (SD)</b>							
Virtual Visit	Mean (SD)	16.15 ± 11.38	18.63 ± 12.43	6.86 ± 4.79	13.69 ± 10.01	12.16 ± 8.73	18.65 ± 9.27
Virtual or In-person visit	Mean (SD)	14.88 ± 11.56	17.36 ± 12.64	6.52 ± 4.79	11.61 ± 9.39	10.51 ± 8.43	18.06 ± 8.83

\* Small sample

**Table 9: Type of family practice among primary care physicians who saw a patient at an outpatient visit that was followed by an ED admission within 7d (July 1 to September 30, 2021)**

Type of family practice	Type of outpatient visit	
	Virtual visit, n(%)	Virtual or in-person visit, n(%)
Blended Capitation	3,051 (27.3%)	3,245 (24.8%)
Enhanced fee-for-service	2,737 (24.5%)	2,895 (22.1%)
Blended Capitation with an interprofessional Family Health Team	2,867 (25.6%)	3,102 (23.7%)
Not in a patient enrolment model (fee-for-service only)	97 (0.9%)	114 (0.9%)
Not attributable to a primary care physician	2,437 (21.8%)	3,756 (28.7%)



## PHYSICIAN CHARACTERISTICS SUMMARY

- There does not seem to be a shift in the type of physicians seeing patients within the week prior to ED admission.
- Most physicians providing care immediately before an ED admission are primary care physicians, followed by psychiatry, pediatrics, internal medicine, and obstetrics and gynecology.
- Looking at the distribution of virtual care to in-person care across physicians who provided care last before ED admissions, we see that there are striking differences among specialties in terms of the modality of care they use across their practice. For example, while most primary care providers practiced with 25 to 75% of their care in-person, most psychiatrists were providing less than 10% of their care in-person, while obstetrics and gynecology physicians were providing most of their care in-person. This highlights the importance of taking specialty into consideration when both evaluating virtual care and designing new models of care.
- There were no physician characteristics differences (age, sex, years in practice, patient volume, and region of practice) with regards to physicians who provided virtual care as the last visit before admission and those that provided in-person or virtual care.

# 4. Discussion

## Key Findings and Implications

1. **No evidence of a rise in ED admission volumes and pre-admission outpatient care compared to the pre-COVID period.**

The number of ED admissions in 2021 was very similar to that in 2019 (1,080,334 vs. 1,113,230). This suggests that the use of virtual care, which was about 50% of all ambulatory care<sup>1</sup> at the time, did not lead to an increase in ED admissions. What changed, however, was the modality of the outpatient visits ahead of ED admissions. These shifted in 2021 to a somewhat equal split between in-person and virtual visits, which is not surprising given 50% of outpatient care during COVID-19 has shifted to virtual. More importantly, there was no change in the overall volume of patients going into the ED with a recent outpatient

visit (about 25% of patients had a visit within 7 days of ED admission both in 2019 and 2021), nor did the number of outpatient visits before ED admissions change (about 1.3 visits in the 7 days prior). There was no overall increase in ED-related outpatient visits because patients were triaged through different pathways, with virtual visits replacing in-person ones rather than having patients seen virtually then in-person prior to being sent to ED.

**2. Patients seen virtually before ED admission had better access to care in the year prior.**

Patients who had virtual visits in the 7 days before their ED admission had on average a higher number of outpatient visits in the year ahead of their ED admission (19 visits/year vs. 11 visits/year for those with no prior virtual care, and 10 visits/year for those without any outpatient visits in the week leading to their ED admission). While this may suggest greater severity of disease, there were no differences in the number of hospitalizations or ED admissions in the year prior to admission suggesting that the difference may lie in better access to care in the week leading to their ED admission.

**3. Patients seen virtually before ED were appropriately triaged to an ED**

Patients who were admitted to the ED after a virtual visit were more likely to be hospitalized (about 12% vs 9% of those with no prior virtual visits), suggesting that the outpatient providers may be more likely to triage them appropriately to the ED, sending a higher proportion of patients who needed hospital admission.

**4. Various outpatient visit modalities can lead directly to ED admission (the virtual to in-person to ED care pathway is not always necessary).**

In 2019, 37% of ED admissions had a same day outpatient visit. In 2021, 39% of patients had any same day outpatient visit (either virtual or in-person). A slightly larger percentage of patients had a same day in-person visit (42%) than same day virtual (37%). This means that for many providers, a virtual visit was sufficient to decide to send a patient to the ED. This is further supported by the finding that slightly more virtual than in-person visits were preceded by another in the 7 days leading to the ED admission.

**5. Rural patients and those in the North region have less access to care, including virtual, which may contribute to inappropriate ED visits.**

Patients in North regions and rural regions seem to have less access to care, including virtual, prior to ED admissions relative to urban patients and those living in Toronto Central and Central Regions. Poor access to care, including virtual, especially during the pandemic,

may make patients more likely to go directly to the ED and constituted a missed opportunity to use virtual care as a potential avenue for diverting some patients away from the ED.

**6. Chronic disease patients who visit the ED have good access to virtual care**

Patients with hypertension, asthma, and diabetes had frequent admissions to ED and they were more likely to have had access to virtual care before their admission and to have had exclusively virtual care as opposed to a mix of virtual and in-person care. This trend was also observed in other chronic conditions such as CHF, COPD, and age-related conditions such as dementia and arthritis. As noted above, this varies regionally.

**7. Health administrative data on income and marginalization does not suggest different access to virtual care prior to ED admissions, so individual level data needs to be explored.**

There were no differences in income or marginalization index measures across groups of patients with varying use of virtual care prior to ED admission. This is consistent with our past report on no differences across income in the use of virtual care<sup>6</sup>. Given the large body of research suggesting there are differences in virtual care access, we believe that this finding should be interpreted with caution.

**8. Most patients went straight to the ED without receiving any virtual or in-person care beforehand (75% of patients in 2021 and 74% of patients in 2019) and many of those visits could have been addressed virtually.**

While the relative portion of patients going to the ED without a prior visit has not changed from 2019 to 2021, there seems to be an opportunity to examine what are some of the most common reasons for going to the ED without prior visits and explore avenues for supporting these patients through virtual care ahead of their decision to go to the ED. For example, urinary tract infections constitute 9% of all admissions without prior visits, most of which could be addressed virtually.

## Limitations

Limitations of this report include the use of administrative databases which lack the clinical granularity to assess details such as the appropriateness of the visit(s). Second, the recent temporary COVID-19 virtual billing codes do not distinguish between telephone and video, and therefore we were unable to make comparisons of the various modalities of virtual care. Third,

this report focuses on patients who had either a virtual only or a mixed virtual and in-person visit trajectory prior to their ED admission, meaning further investigation needs to be done on the subgroup of patients who had in-person care only prior to their admission. Lastly, the findings in this report are descriptive only and span a short period of three months, and therefore results are only preliminary and may not be generalizable in different contexts.

## Future Research and Next Steps

1. Concentrate on the key conditions listed as top reasons for ED admissions or prior outpatient visits, such as chest pain, acute infections (UTI/URI), and mental health crises in order to explore in more detail the nature and pathway of outpatient visits before ED admission and the effectiveness of virtual care in these higher ED user patient populations.
2. Leverage this descriptive data to conduct a matched cohort study that would aim to explore the association between virtual care and subsequent ED admissions. This would allow us to capture all the cases when patients had a virtual visit and an ED admission was avoided. This would need to be limited to more homogenous conditions and populations.
3. Analyze data during other times of the year, such as the winter months. It is likely that during the summer, there are not as many cold/flu type disorders that lead to a high number of ED admission; thus, it is possible that ED admissions are generally higher in the winter and may affect the conclusions derived from these findings.
4. Continue to monitor how virtual care may impact ED admissions as we return to pre-pandemic behaviors and create a virtual dashboard to monitor the changing environment in Ontario.

## 5. Conclusion

Despite concerns that access to virtual care may lead to a rise in ED admissions or a greater use of outpatient services prior to ED admissions (in the form of patients having both virtual and in-person visits), the net amount of ED admissions and outpatient care prior to admission remained the same over a period of the COVID-19 pandemic when cases were relatively stable. Virtual care seems to be able to appropriately triage patients to the ED and may even prove beneficial for diverting patients away from the ED when an ED visit is not

appropriate. There is also no evidence to support a sharp increase in use of virtual visits prior to ED visits. Access to virtual care, however, seems poor in rural and especially North regions and improving virtual care access in these regions seems like an important next step.

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# Appendices

## Appendix 1. Methodology

**Table 1: Health administrative databases used in this analysis.**

<b>Population and demographics</b>	
<b>Registered Persons Database (RPDB)</b>	Contains demographic information on individuals covered under OHIP and eligible for the Ontario Drug Program
<b>Postal Code Conversion File (PCCF)</b>	Links postal codes to standard geographic areas and census data
<b>Ontario Marginalization Index (ONMARG)</b>	Contains data on patient economic, ethno-racial, age-based, and social deprivation
<b>Health services utilization</b>	
<b>Canadian Institute for Health Information Discharge Abstract Database (DAD)</b>	Contains data on inpatient hospital admissions and discharges
<b>Canadian Institute for Health Information National Ambulatory Care Reporting System (NACRS)</b>	Contains data on all hospital- and community-based ambulatory care, including ED admissions
<b>Canadian Institute for Health Information Same Day Surgery (SDS)</b>	Contains records of same day surgeries
<b>Ontario Health Insurance Plan (OHIP)</b>	Contains records of health services delivered by physicians to patients eligible for OHIP
<b>Ontario Drug Benefit (ODB)</b>	Contains data on prescription claims among patients aged 65+
<b>Ontario Mental Health Reporting System (OMHRS)</b>	Contains information on use of adult mental health services
<b>Narcotics Monitoring System (NMS)</b>	Contains records of dispensed prescriptions for narcotics and other monitored medications
<b>Physician databases</b>	
<b>ICES Physician Database (IPDB)</b>	Contains data on physician demographic and practice characteristics
<b>Corporate Provider Database (CPDB)</b>	Contains data on physician demographic and practice characteristics
<b>Client Agency Program Enrolment (CAPE)</b>	Contains records of patients registered to specific physician and primary care organizations
<b>Other clinical data</b>	
<b>Ontario Hypertension dataset (HYPER)</b>	ICES-derived cohort of patients diagnosed with hypertension

<b>Ontario Diabetes Dataset (ODD)</b>	ICES-derived cohort of patients diagnosed with diabetes
<b>Chronic Obstructive Pulmonary Disease dataset (COPD)</b>	ICES-derived cohort of patients diagnosed with COPD
<b>Ontario Asthma dataset (ASTHMA)</b>	ICES-derived cohort of patients diagnosed with asthma
<b>Congestive Heart Failure dataset (CHF)</b>	ICES-derived cohort of patients diagnosed with congestive heart failure
<b>Ontario Dementia database (DEMENTIA)</b>	ICES-derived cohort of patients diagnosed with dementia
<b>Ontario HIV database (HIV)</b>	ICES-derived cohort of patients diagnosed with HIV
<b>Ontario Crohn's and Colitis Cohort dataset (OCCC)</b>	ICES-derived cohort of patients diagnosed with Crohn's disease
<b>Ontario Rheumatoid Arthritis Database (ORAD)</b>	ICES-derived cohort of patients diagnosed with arthritis

**Table 2: Patient characteristics extracted for each subgroup of interest in Objective 1.**

<b>Patient characteristics</b>
Age
Sex
Region
Neighbourhood income quintile
Ontario Marginalization Index
Rurality
Major disease diagnosis
Overall healthcare utilization in the past year (# ED admissions, # hospitalizations, # physician visits)
Reason for ED visit
Reason for virtual visit
Number of outpatient visits in past 7 days
Mode of outpatient visits in past 7 days (% virtual only, % in-person only, % virtual and in-person)
Number of days between virtual visit and ED visit
Use of B versus K code on virtual visit
Number of ED admissions that resulted in hospitalization
Number of ED admissions that are CTAS level 4 or 5

**Table 3: Outpatient visit characteristics extracted for each subgroup of interest in Objective 2.**

<b>Visit characteristics</b>
Type of visit (initial vs. urgent follow-up)
Reason for visit
Number of visits that resulted in ED visit within 24h
Number of visits that resulted in ED visit within 48h
Number of visits that resulted in ED visit within 72h
Use of B vs K codes
Number of days between most recent outpatient visit and ED visit
Number of outpatient visits that were preceded by another outpatient visit within 7 days

**Table 4: Physician characteristics that were extracted for each subgroup of interest in Objective 3.**

<b>Physician characteristics</b>
Age
Sex
Region of practice
Years since graduation
Practice patterns during study window (based on the proportion of in-person visits delivered: 10% or less, between 10-25%, between 25-50%, between 50-75%, more than 75%)
Type of family practice (i.e. enrolment model for primary care physicians)
Patient volumes during study window
Average patient volume per day during study window



## Appendix 2. Overall Results

Table 5: Top 20 reasons for ED admission, July 1 to September 30, 2021

	All patients with an ED visit	No prior virtual visits	No prior visits	Virtual care within 24hr	Virtual care within 48hr	Virtual care within 72hr	Virtual care within 7d	In-person care only 7d
Chest pain, unspecified	38,183 (14.1%)	31,859 (13.8%)	27,735 (13.6%)	3,321 (15.7%)	3,964 (15.6%)	4,497 (15.5%)	6,324 (15.8%)	4,124 (15.1%)
Other and unspecified abdominal pain	29,859 (11.0%)	24,688 (10.7%)	21,029 (10.3%)	2,480 (11.8%)	3,066 (12.1%)	3,536 (12.2%)	5,171 (12.9%)	3,659 (13.4%)
Urinary tract infection, site not specified	25,309 (9.3%)	21,648 (9.3%)	18,981 (9.3%)	1,736 (8.2%)	2,176 (8.6%)	2,591 (9.0%)	3,661 (9.1%)	2,667 (9.77%)
Acute upper respiratory infection, unspecified	15,235 (5.6%)	13,063 (5.6%)	12,004 (5.9%)	1,429 (6.8%)	1,646 (6.5%)	1,797 (6.2%)	2,172 (5.4%)	1,059 (3.88%)
Open wound of finger(s) without damage to nail, uncomplicated	14,781 (5.4%)	14,035 (6.1%)	13,181 (6.5%)	272 (1.3%)	345 (1.4%)	439 (1.5%)	746 (1.9%)	854 (3.13%)
Other chest pain	13,425 (4.9%)	11,459 (5.0%)	10,116 (5.0%)	1,076 (5.1%)	1,304 (5.1%)	1,459 (5.0%)	1,966 (4.9%)	1,343 (4.92%)
Unspecified injury of head	11,856 (4.4%)	10,788 (4.7%)	9,642 (4.7%)	495 (2.3%)	591 (2.3%)	684 (2.4%)	1,068 (2.7%)	1,146 (4.2%)
Low back pain	11,683 (4.3%)	10,158 (4.4%)	9,222 (4.5%)	670 (3.2%)	858 (3.4%)	1,029 (3.6%)	1,525 (3.8%)	936 (3.43%)
Sprain and strain of ankle, unspecified	10,757 (4.0%)	10,078 (4.4%)	9,492 (4.6%)	307 (1.5%)	392 (1.5%)	458 (1.6%)	679 (1.7%)	586 (2.15%)
Fever, unspecified	10,747 (4.0%)	8,503 (3.7%)	7,137 (3.5%)	1,590 (7.5%)	1,795 (7.1%)	1,911 (6.6%)	2,244 (5.6%)	1,366 (5%)
Gastroenteritis and colitis of unspecified origin	10,354 (3.8%)	8,405 (3.6%)	7,439 (3.6%)	1,101 (5.2%)	1,318 (5.2%)	1,489 (5.2%)	1,949 (4.9%)	1,321 (4.84%)
Headache	10,365 (3.8%)	8,180 (3.5%)	6,859 (3.4%)	1,152 (5.5%)	1,410 (5.6%)	1,600 (5.53%)	2,185 (5.5%)	966 (3.54%)
Dizziness and giddiness	10,342 (3.8%)	8,697 (3.8%)	7,513 (3.7%)	819 (3.9%)	1,012 (4.0%)	1,135 (3.9%)	1,645 (4.1%)	1,184 (4.34%)

<b>Viral infection, unspecified</b>	9,733 (3.6%)	8,058 (3.5%)	7,297 (3.6%)	1,142 (5.4%)	1,286 (5.1%)	1,394 (4.8%)	1,675 (4.2%)	761 (2.79%)
<b>Syncope and collapse</b>	9,709 (3.6%)	8,553 (3.7%)	7,517 (3.7%)	493 (2.3%)	627 (2.5%)	744 (2.6%)	1,156 (2.9%)	1,036 (3.79%)
<b>Cellulitis of lower limb</b>	8,949 (3.3%)	7,644 (3.3%)	6,404 (3.1%)	629 (3.0%)	781 (3.1%)	908 (3.1%)	1,305 (3.3%)	1,240 (4.54%)
<b>Open wounds of other parts of head, uncomplicated</b>	7,791 (2.9%)	7,409 (3.2%)	6,889 (3.4%)	148 (0.7%)	183 (0.7%)	232 (0.8%)	382 (1.0%)	520 (1.9%)
<b>Acute pharyngitis, unspecified</b>	7,638 (2.8%)	6,502 (2.8%)	6,029 (3.0%)	731 (3.5%)	831 (3.3%)	934 (3.2%)	1,136 (2.8%)	473 (1.73%)
<b>Malaise and fatigue</b>	7,532 (2.8%)	6,087 (2.6%)	5,078 (2.5%)	670 (3.2%)	847 (3.3%)	975 (3.4%)	1,445 (3.6%)	1,009 (3.7%)
<b>Dyspnoea</b>	7,514 (2.8%)	5,905 (2.6%)	4,853 (2.4%)	848 (4.0%)	986 (3.9%)	1,128 (3.9%)	1,609 (4.0%)	1,052 (3.85%)

**Table 6: Top 20 reasons for most recent virtual visit prior to ED admission, July 1 to September 30, 2021**

	<b>All patients with an ED visit</b>	<b>Virtual care within 24hr</b>	<b>Virtual care within 48hr</b>	<b>Virtual care within 72hr</b>	<b>Virtual care within 7d</b>	<b>In-person care only 7d</b>
<b>Other</b>	8,926 (11.6%)	4,961 (12.2%)	5,935 (12.1%)	6,635 (11.9%)	8,926 (11.6%)	4,601 (9.43%)
<b>Anorexia/GI Problems</b>	8,880 (11.6%)	5,634 (13.9%)	6,444 (13.1%)	7,060 (12.6%)	8,880 (11.6%)	6,522 (13.36%)
<b>Anxiety/Neurosis</b>	8,263 (10.8%)	2,921 (7.2%)	3,968 (8.1%)	4,941 (8.8%)	8,263 (10.8%)	6,285 (12.88%)
<b>Chest pain/tachycardia</b>	5,787 (7.5%)	4,086 (10.1%)	4,506 (9.2%)	4,832 (8.7%)	5,787 (7.5%)	4,008 (8.21%)
<b>Leg/Joint Pain</b>	5,178 (6.8%)	2,755 (6.8%)	3,313 (6.8%)	3,774 (6.8%)	5,178 (6.8%)	3,723 (7.63%)
<b>Acute nasopharyngitis/common cold</b>	4,268 (5.6%)	2,893 (7.1%)	3,342 (6.8%)	3,665 (6.6%)	4,268 (5.6%)	1,417 (2.9%)
<b>Drug dependence, drug addiction</b>	3,923 (5.1%)	1,219 (3.0%)	1,766 (3.6%)	2,278 (4.1%)	3,923 (5.1%)	1,782 (3.65%)
<b>Diabetes mellitus</b>	3,842 (5.0%)	1,306 (3.2%)	1,760 (3.6%)	2,217 (4.0%)	3,842 (5.0%)	2,914 (5.97%)
<b>Convulsions, ataxia, vertigo, headache</b>	3,576 (4.7%)	2,316 (5.7%)	2,653 (5.4%)	2,892 (5.2%)	3,576 (4.7%)	2,187 (4.48%)
<b>Epistaxis, hemoptysis, cough, dyspnea, shortness of breath</b>	3,206 (4.2%)	1,928 (4.8%)	2,245 (4.6%)	2,493 (4.5%)	3,206 (4.2%)	1,470 (3.01%)

<b>Hypertension</b>	2,872 (3.7%)	1,115 (2.8%)	1,464 (3.0%)	1,766 (3.2%)	2,872 (3.7%)	2,412 (4.94%)
<b>Other disorders of urinary tract</b>	2,656 (3.5%)	1,287 (3.2%)	1,630 (3.3%)	1,907 (3.4%)	2,656 (3.5%)	1,684 (3.45%)
<b>Other non-specific abnormal findings</b>	2,582 (3.4%)	1,599 (4.0%)	1,865 (3.8%)	2,053 (3.7%)	2,582 (3.4%)	1,068 (2.19%)
<b>Diarrhea, gastro-enteritis, viral gastro-enteritis</b>	1,983 (2.6%)	1,200 (3.0%)	1,464 (3.0%)	1,624 (2.9%)	1,983 (2.6%)	591 (1.21%)
<b>Lumbar Issues</b>	1,946 (2.5%)	818 (2.0%)	1,068 (2.2%)	1,276 (2.3%)	1,946 (2.5%)	1,553 (3.18%)
<b>Cystitis</b>	1,835 (2.4%)	854 (2.1%)	1,102 (2.3%)	1,314 (2.4%)	1,835 (2.4%)	898 (1.84%)
<b>Cellulitis, abscess</b>	1,795 (2.3%)	1,149 (2.8%)	1,358 (2.8%)	1,488 (2.7%)	1,795 (2.3%)	863 (1.77%)
<b>Other viral diseases</b>	1,649 (2.2%)	1,199 (3.0%)	1,379 (2.8%)	1,473 (2.6%)	1,649 (2.2%)	2,101 (4.31%)
<b>Depressive or other non-psychotic disorders</b>	1,838 (2.4%)	625 (1.5%)	837 (1.7%)	1,052 (1.9%)	1,838 (2.4%)	2,220 (4.55%)
<b>Normal delivery, uncomplicated pregnancy</b>	1,759 (2.3%)	725 (1.8%)	944 (1.9%)	1,127 (2.0%)	1,759 (2.3%)	504 (1.03%)

**Table 7: Top 20 reasons for most recent outpatient visit that occurred within 7d prior to ED admissions**

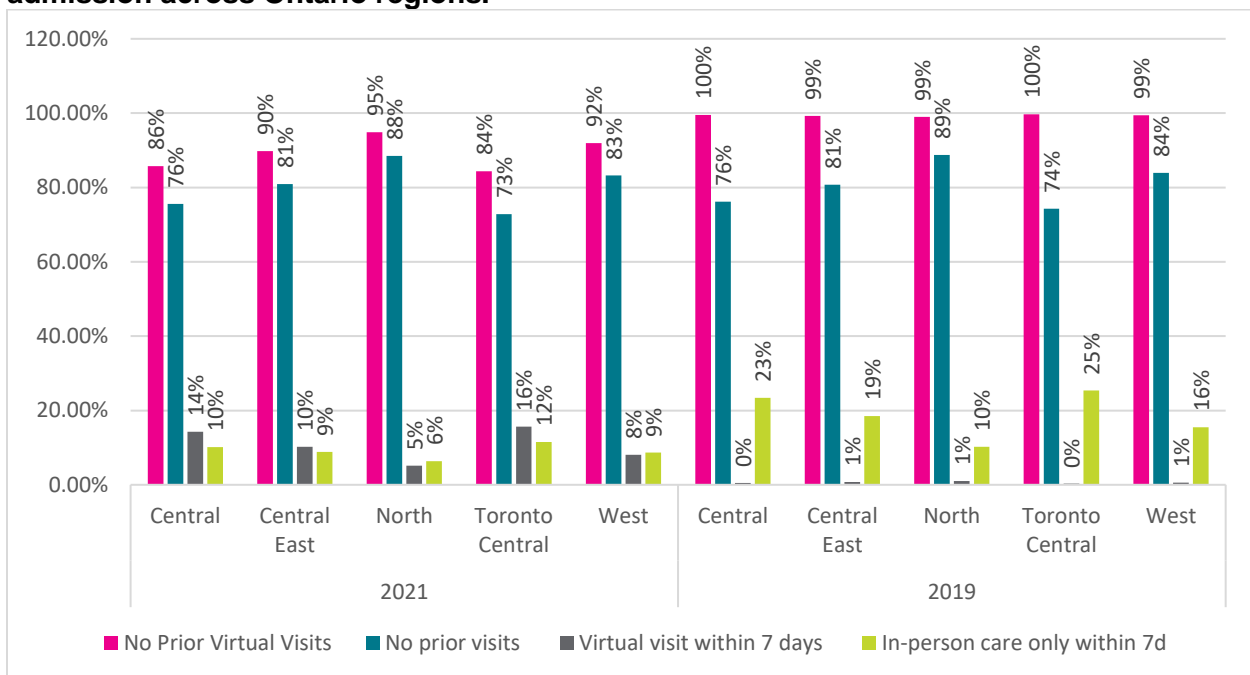
	Any OP visit 2021	Virtual OP visit 2021	In-person OP visit 2021	In-person OP visit 2019
	N=277,901	N=134,591	N=143,310	N=273,427
<b>Anorexia/GI Problems</b>	15,883 (12.7%)	8,040 (11.9%)	7,843 (13.6%)	16,328 (13.6%)
<b>Anxiety/Neurosis</b>	14,638 (11.7%)	7,119 (10.5%)	7,519 (13.0%)	12,740 (10.6%)
<b>Other ill-defined conditions</b>	13,120 (10.5%)	7,901 (11.6%)	5,219 (9.0%)	9,892 (8.3%)
<b>Chest pain/tachycardia</b>	10,082 (8.0%)	5,323 (7.8%)	4,759 (8.2%)	9,022 (7.5%)
<b>Leg/Joint Pain</b>	8,687 (6.9%)	4,620 (6.8%)	4,067 (7.0%)	8,370 (7.0%)
<b>Diabetes mellitus</b>	6,452 (5.1%)	3,364 (5.0%)	3,088 (5.4%)	6,550 (5.5%)
<b>Convulsions, ataxia, vertigo, headache</b>	5,900 (4.7%)	3,239 (4.8%)	2,661 (4.6%)	5,745 (4.8%)
<b>Acute nasopharyngitis/common cold</b>	5,566 (4.4%)	3,939 (5.8%)	1,627 (2.8%)	7,570 (6.3%)
<b>Drug dependence, drug addiction</b>	5,443 (4.3%)	3,540 (5.2%)	1,903 (3.3%)	3,361 (2.8%)
<b>Hypertension</b>	5,066 (4.0%)	2,538 (3.7%)	2,528 (4.4%)	5,642 (4.7%)
<b>Epistaxis, hemoptysis, cough, dyspnea, shortness of breath</b>	4,737 (3.8%)	2,933 (4.3%)	1,804 (3.1%)	4,210 (3.5%)
<b>Other disorders of urinary tract</b>	4,251 (3.4%)	2,349 (3.5%)	1,902 (3.3%)	4,125 (3.4%)
<b>Cellulitis, abscess</b>	4,182 (3.3%)	1,599 (2.4%)	2,583 (4.5%)	5,174 (4.3%)
<b>Normal delivery, uncomplicated pregnancy</b>	3,789 (3.0%)	1,551 (2.3%)	2,238 (3.9%)	3,674 (3.1%)
<b>Other non-specific abnormal findings</b>	3,578 (2.9%)	2,324 (3.4%)	1,254 (2.2%)	2,826 (2.4%)
<b>Lumbar Issues</b>	3,457 (2.8%)	1,744 (2.6%)	1,713 (3.0%)	3,300 (2.8%)
<b>Osteoarthritis</b>	2,825 (2.3%)	1,030 (1.5%)	1,795 (3.1%)	2,764 (2.3%)
<b>Eczema, atopic dermatitis, neurodermatitis</b>	2,804 (2.2%)	1,298 (1.9%)	1,506 (2.6%)	3,222 (2.7%)
<b>Depressive or other non-psychotic disorders</b>	2,621 (2.1%)	1,578 (2.3%)	1,043 (1.8%)	2,567 (2.1%)
<b>Diarrhea, gastro-enteritis, viral gastro-enteritis</b>	2,516 (2.0%)	1,829 (2.7%)	687 (1.2%)	2,866 (2.4%)

## Appendix 3. Less or Non-Urgent ED Admissions Results

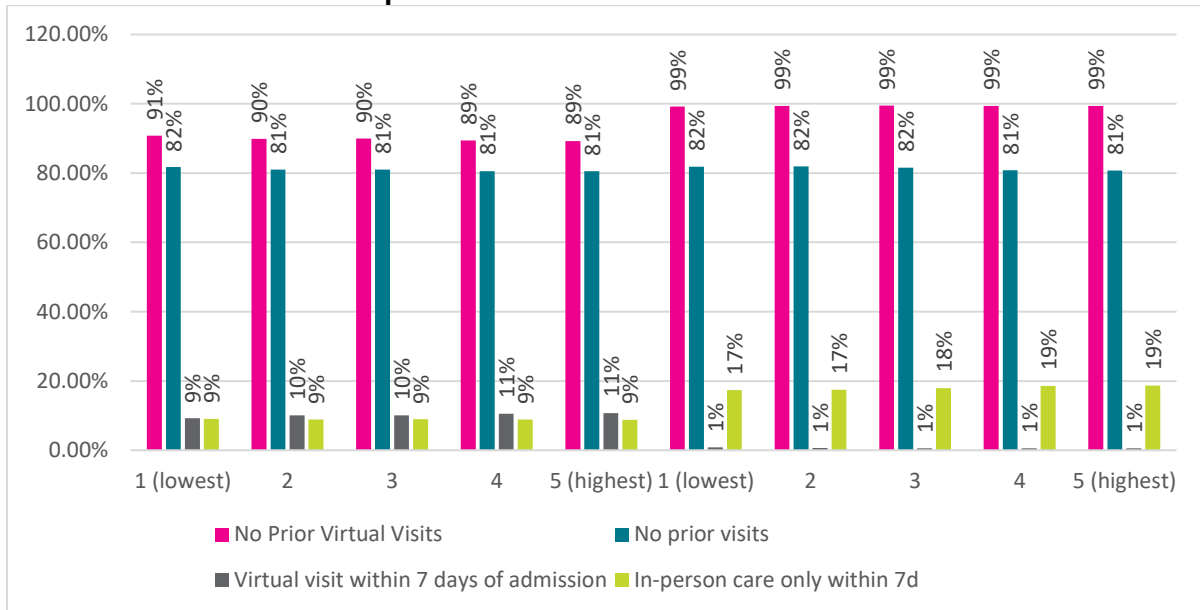
**Table 8: Mean number of outpatient visits in the 7 days before ED admission, Mean (SD)**

	All patients	No Prior Virtual Visits	24hr	48hr	72hr	7d	In-person only 7d
<b>2021</b>	1.26 ± 0.58	1.14 ± 0.41	1.44 ± 0.75	1.43 ± 0.73	1.42 ± 0.72	1.37 ± 0.68	1.14 ± 0.41
<b>2019</b>	1.21 ± 0.52	1.21 ± 0.51	1.32 ± 0.64	1.31 ± 0.63	1.30 ± 0.62	1.30 ± 0.64	1.21 ± 0.51

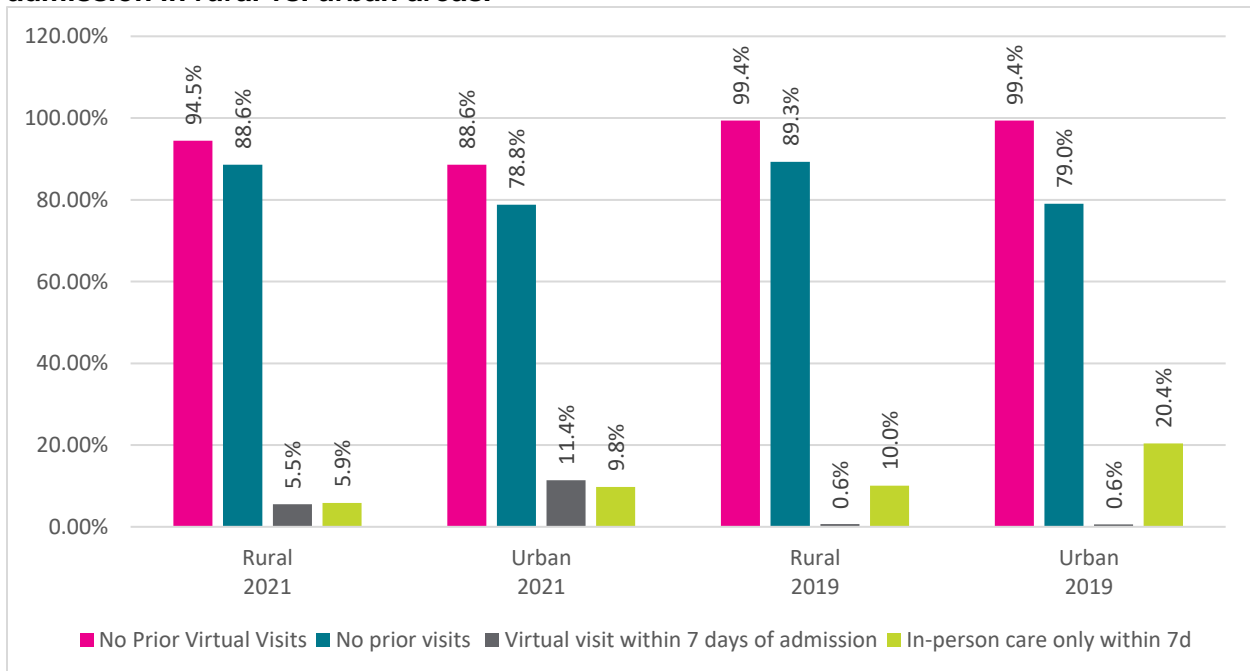
**Figure 1. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person) and with virtual visits with 7 days of non- or less urgent ED admission across Ontario regions.**



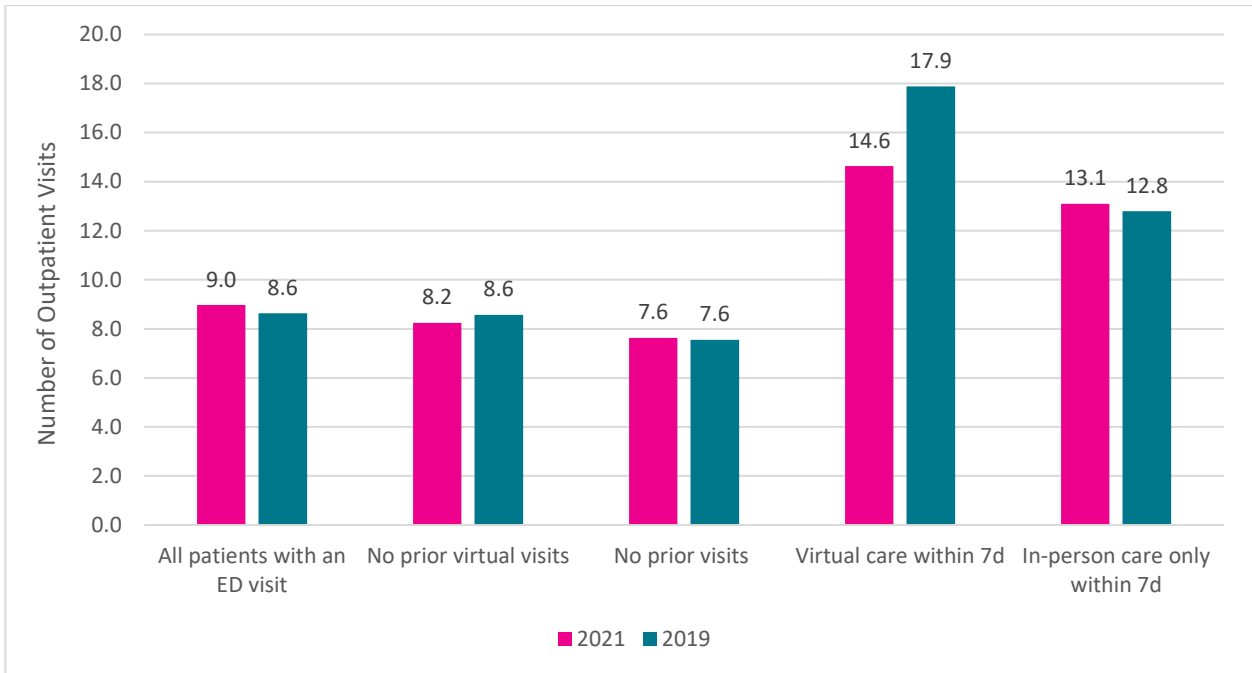
**Figure 2. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person) and with virtual visits with 7 days of non- or less urgent ED admission across income quintiles.**



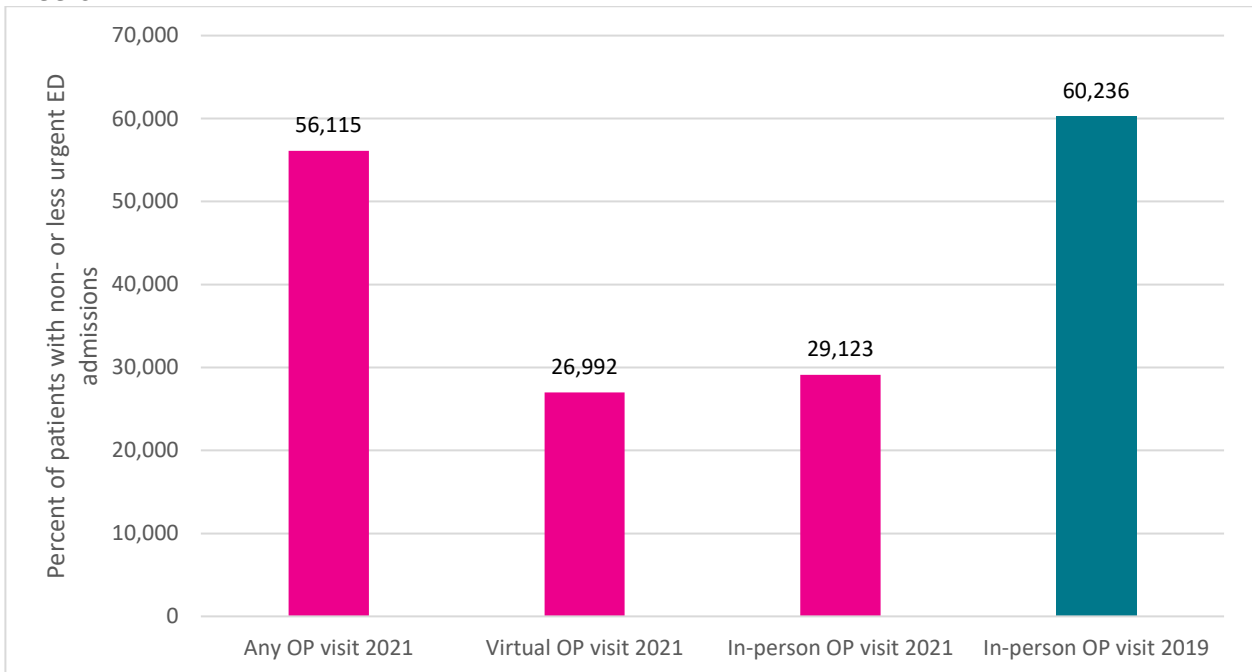
**Figure 3. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person), and with virtual visits with 7 days of non- or less urgent ED admission in rural vs. urban areas.**



**Figure 4. Number of Outpatient Visits in the year prior to non- or less urgent ED admissions**



**Figure 5. Percentage of patients with no prior virtual visits, no prior outpatient visits (virtual or in-person) and with virtual visits within 7 days of non- or less urgent ED admission.**



**Table 9: Characteristics of outpatient visits that occurred within 7d prior to less/non-urgent care ED admissions**

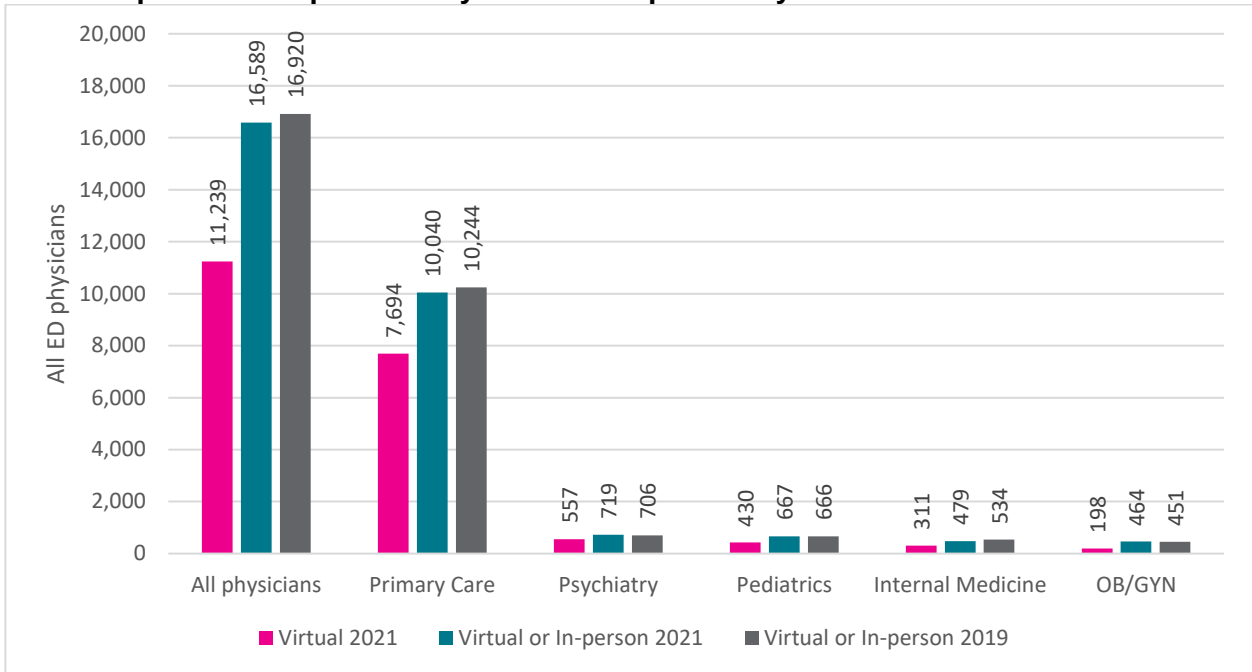
Type of visit, N (%)	Any OP visit 2021 N=56,115	Virtual OP visit 2021 N=26,992	In-person OP visit 2021 N=29,123	In-person OP visit 2019 N=60,236
Initial	51,944 (92.6%)	24,537 (90.9%)	27,407 (94.1%)	57,325 (95.2%)
Urgent follow-up	4,171 (7.4%)	2,455 (9.1%)	1,716 (5.9%)	2,911 (4.8%)
<b>Number of days between OP and ED visit, mean (SD)</b>				
Mean ± SD	2.15 ± 2.30	2.16 ± 2.27	2.13 ± 2.33	2.34 ± 2.34
Median (IQR)	1(0 - 4)	1(0 - 4)	1(0 - 4)	2(0 - 4)
<b>OP visit same day as ED visit, N (%)</b>				
No	35,172 (62.7%)	17,580 (65.1%)	17,592 (60.4%)	39,935 (66.3%)
Yes	20,943 (37.3%)	9,412 (34.9%)	11,531 (39.6%)	20,301 (33.7%)
<b>OP visit preceded by another within 7d, N (%)</b>				
No	40,676 (72.5%)	19,303 (71.5%)	21,373 (73.4%)	45,502 (75.5%)
Yes	15,439 (27.5%)	7,689 (28.5%)	7,750 (26.6%)	14,734 (24.5%)
<b>Virtual visit code, N (%)</b>				
No virtual visit	29,123 (51.9%)	0 (0.0%)	29,123(100.0%)	60,236 (100.0%)
Virtual visit - B code	1,482 (2.6%)	1,482 (5.5%)	0 (0.0%)	0 (0.0%)
Virtual visit - K code	25,510 (45.5%)	25,510 (94.5%)	0 (0.0%)	0 (0.0%)

**Table 10: Top 20 reasons for most recent outpatient visit that occurred within 7d prior to non/less urgent ED admissions**

	Any OP visit 2021	Virtual OP visit 2021	In-person OP visit 2021	In-person OP visit 2019
	N=56,115	N=26,992	N=29,123	N=60,236
Other ill-defined conditions	2,794 (11.6%)	1,705 (13.4%)	1,089 (9.6%)	2,379 (9.5%)
Anxiety/Neurosis	2,739 (11.4%)	1,485 (11.6%)	1,254 (11.1%)	2,550 (10.2%)
Leg/Joint Pain	2,362 (9.8%)	1,268 (9.9%)	1,094 (9.7%)	2,416 (9.7%)
Anorexia/GI Problems	1,867 (7.7%)	1,016 (8.0%)	851 (7.5%)	1,812 (7.3%)
Cellulitis, abscess	1,373 (5.7%)	563 (4.4%)	810 (7.2%)	1,773 (7.1%)
Acute nasopharyngitis, common cold	1,344 (5.6%)	887 (6.9%)	457 (4.0%)	1,676 (6.7%)
Drug dependence, drug addiction	1,197 (5.0%)	712 (5.6%)	485 (4.3%)	804 (3.2%)
Diabetes mellitus	1,069 (4.4%)	574 (4.5%)	495 (4.4%)	1,226 (4.9%)
Eczema, atopic dermatitis, neurodermatitis	1,046 (4.3%)	489 (3.8%)	557 (4.9%)	1,215 (4.9%)
Chest pain/tachycardia	901 (3.7%)	489 (3.8%)	412 (3.6%)	806 (3.2%)
Ankle, foot, toes	860 (3.6%)	423 (3.3%)	437 (3.9%)	986 (4.0%)
Other disorders of skin and subcutaneous tissue	817 (3.4%)	305 (2.4%)	512 (4.5%)	873 (3.5%)
Convulsions, ataxia, vertigo, headache	797 (3.3%)	457 (3.6%)	340 (3.0%)	811 (3.3%)
Essential, benign hypertension	775 (3.2%)	394 (3.1%)	381 (3.4%)	980 (3.9%)
Epistaxis, hemoptysis, cough, dyspnea, shortness of breath	762 (3.2%)	510 (4.0%)	252 (2.2%)	703 (2.8%)
Other disorders of urinary tract	739 (3.1%)	407 (3.2%)	332 (2.9%)	791 (3.2%)
Abrasions, bruises, contusions	721 (3.0%)	336 (2.6%)	385 (3.4%)	896 (3.6%)
Normal delivery, uncomplicated pregnancy	686 (2.9%)	265 (2.1%)	421 (3.7%)	730 (2.9%)
Wrist, hand, fingers	636 (2.6%)	251 (2.0%)	385 (3.4%)	780 (3.1%)
Other injuries or trauma	626 (2.6%)	239 (1.9%)	387 (3.4%)	769 (3.1%)



**Figure 6. All physicians who saw a patient with an ED admission that was preceded by a virtual or in-person visit provided by them in the past 7 days**



**Figure 7. All physicians who saw a patient with a non- or less urgent ED admission that was preceded by a virtual visit in the past 7 days (2021)**

