Health care utilization and outcomes of patients seen by virtual urgent care versus in-person emergency department care

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Abstract

Background: Virtual urgent care (VUC) is intended to support diversion of patients with low-acuity complaints and reduce the need for in-person emergency department visits. We aimed to describe subsequent health care utilization and outcomes of patients who used VUC compared with similar patients who had an in-person emergency department visit.

Methods: We used patient-level encounter data that were prospectively collected for patients using VUC services provided by 14 pilot programs in Ontario, Canada. We linked the data to provincial administrative databases to identify subsequent 30-day health care utilization and outcomes. We defined 2 subgroups of VUC users; those with a documented prompt referral to an emergency department by a VUC provider, and those without. We matched patients in each cohort to an equal number of patients presenting to an emergency department in person, based on encounter date, medical concern and the logit of a propensity score. For the subgroup of patients not promptly referred to an emergency department, we matched patients to those who were seen in an emergency department and then discharged home.

Results: Of the 19 595 patient VUC visits linked to administrative data, we matched 2129 patients promptly referred to the emergency department by a VUC provider to patients presenting to the emergency department in person. Index visit hospital admissions (9.4% v. 8.7%), 30-day emergency department visits (17.0% v. 17.5%), and hospital admissions (12.9% v. 11.0%) were similar between the groups. We matched 14 179 patients who were seen by a VUC provider with no documented referral to the emergency department. Patients seen by VUC were more likely to have a subsequent in-person emergency department visit within 72 hours (13.7% v. 7.0%), 7 days (16.5% v. 10.3%) and 30 days (21.9% v. 17.9%), but hospital admissions were similar within 72 hours (1.1% v. 1.3%), and higher within 30 days for patients who were discharged home from the emergency department (2.6% v. 3.4%).

Interpretation: The impact of the provincial VUC pilot program on subsequent health care utilization was limited. There is a need to better understand the inherent limitations of virtual care and ensure future virtual providers have timely access to in-person outpatient resources, to prevent subsequent emergency department visits.

The COVID-19 pandemic has had a substantial impact on the way people in Canada interact with health care systems.[1,2] In the early stages of the pandemic, when physical distancing was strongly encouraged, it was difficult to arrange a nonurgent, in-person health care visit. In-person primary care visits declined by nearly 80%, and emergency department visits decreased by 50%.[3–5] Although technologies to deliver health care through means other than face-to-face contact have been available for decades, the beginning of the COVID-19 pandemic saw large growth and rapid adoption of virtual care.[6,7]

As part of the COVID-19 pandemic response, in the fall of 2020 the Ontario Ministry of Health approved up to $4 million to fund a pilot program involving 14 virtual urgent care (VUC) initiatives across the province.[8] This funding was intended to support emergency department diversion of patients with low-acuity complaints and reduce the need for in-person visits whenever possible. The design and implementation of the 14 emergency department–led virtual sites and the demographic characteristics and experience of patients using VUC have been described elsewhere;[9,10] the 14 different sites had various start dates,

operating hours, screening and staffing models. Each site posted a list of presenting complaints that would be suitable for VUC, and those that should be assessed in person. All patients accessing VUC were assessed by an emergency physician. More information describing the design of the pilot programs can be found in Appendix 1 (available at www.cmaj.ca/lookup/doi/10.1503/cmaj.230492/tab-related-content).

Although the shift to virtual care was intended to maintain safe access to medical care during the pandemic, it occurred despite lack of evidence regarding the comparability of in-person and virtual care models. Given that virtual care options are now more widespread across the health care system, it is important to understand how virtual care compares with traditional in-person care in the emergency department setting. We sought to describe the characteristics and subsequent health care utilization and outcomes of patients using VUC services compared with a matched cohort of similar patients who received traditional in-person emergency department care.

Methods

Study design and setting

We used patient-level encounter data that were prospectively collected for all patients using VUC services provided by 14 emergency department–led pilot sites (including 3 pediatric sites), in Ontario, Canada, from December 2020 to September 2021. The characteristics of the pilot programs are described in Appendix 1. The 14 sites approved for VUC pilot funding represented a mix of pediatric, northern, urban, academic and community sites across the province.[9,10]

Data sources

As part of the funding agreement, each participating VUC site was required to collect and report a minimum of 6 months of standardized patient-level encounter data, which were sent electronically via secure file transfer to Ontario Health. Standardized patient-level encounter data included the patient's health insurance number, age, sex, primary care physician (PCP), date and time of the VUC visit, presenting complaint, acuity level (Canadian Triage and Acuity Scale score 1–5), and the VUC discharge diagnosis (physician diagnosis) and disposition (discharged home, referred to emergency department, referred to PCP, referred to specialist, left without being seen, referred to COVID-19 or outpatient clinic, other). For every patient encounter, the VUC provider documented all patient data at the time of the VUC visit.

We used patient-level encounter data from each VUC visit to link to province-wide administrative health care databases held at ICES (www.ices.on.ca) to identify subsequent health care utilization (emergency department visits, hospital admissions, outpatient specialist or PCP visits) within 30 days. Outpatient specialist or PCP visits were identified based on provincial billing data and location code. We obtained information regarding emergency department visits from the Canadian Institute for Health Information (CIHI) National Ambulatory Care Reporting System, which contains abstracted data on all emergency department visits in Ontario. The CIHI Discharge Abstract Database contains information on all acute care hospital admissions and in-patient surgical procedures in the province. The Ontario Health Insurance Plan (OHIP) Claims History Database contains all physician billings for medically necessary care. The OHIP Registered Persons Database contains demographic and place of residence information, health insurance status and vital status for all people in Ontario, including out-of-hospital deaths. Patients were tracked in these databases at the person level using unique, encoded identifiers. Ontario has publicly funded health care coverage for medically necessary care; therefore, these databases contain information on most of the health care utilization in the province.

Study participants

We required a valid linkable OHIP number for inclusion, and individuals had to have been eligible for OHIP coverage for a minimum of 365 days before the index date. We excluded VUC records if they contained invalid (e.g., incorrect OHIP number) or incomplete data (e.g., patients registered but did not show up for their VUC appointment); we also excluded virtual visits by non-Ontario residents.

As we expected differences in the characteristics of people using VUC or in-person emergency department care, we defined 2 subgroups of VUC users: those attending a VUC appointment, who were promptly referred to an in-person emergency department; and those seen by a VUC provider, with no referral to an in-person emergency department. We matched patients with a VUC discharge disposition of "referred to the emergency department" to a cohort of patients who presented in person to the emergency department with any disposition, and we matched patients seen by a VUC provider with no documented referral to an in-person emergency department to a cohort of patients who presented in person to the emergency department and were discharged home. This allowed us to assess subsequent health care utilization (emergency department visits, hospital admissions, and specialist and primary care visits) and death in patients with similar baseline characteristics. We included patients missing a VUC discharge disposition in the cohort with no documented referral to the emergency department. For each patient in the VUC cohort, we 1:1 greedy-matched a patient presenting to an emergency department in person on the basis of encounter date (± 14 d), presenting Canadian Emergency Department Information System complaint and the logit of a propensity score computed from each patient's age, sex, Statistics Canada Census neighbourhood income quintile, urban or rural residence, Ontario Marginalization Index quintiles related to ethnic diversity, residential instability, material deprivation and dependency, whether patients were rostered with a PCP, number of major Aggregated Diagnostic Groups (ADG) derived from the Johns Hopkins ACG System (version 10; grouped as 0–4, 5–9, 10–14, ≥ 15), selected chronic diseases identified using ICES administrative data case definitions (e.g., asthma, congestive heart failure, hypertension, chronic obstructive pulmonary disease, diabetes and dementia), the time and day of the index visit, number of PCP and specialist physician visits, emergency

department visits and hospital admissions in the year preceding the index date. We used a caliper width of 0.2 of the standard deviation of the logit of the propensity score. We evaluated balance in baseline covariates for each cohort using standardized differences, with values less than 0.10 indicating that the groups were well matched.[11]

Statistical analysis

We summarized data using means with standard deviations or frequencies, where appropriate. We compared proportional differences using χ^2 statistics. All ICES-based analyses were performed using linked, coded data in SAS (version 9.4, SAS Institute). We conducted subsequent statistical analyses using aggregate data in SPSS (version 28.0, IBM Corporation).

Ethics approval

The study received ethics approval from the Research Ethics Board at Sinai Health (21-003-E).

Results

Of the 22 278 patient encounters captured in the provincial VUC program, we were able to match 19 595 (88.0%) to administrative health care databases (Appendix 2, available at available at www.cmaj.ca/lookup/doi/10.1503/cmaj.230492/tab-related-content). The baseline demographic characteristics for all eligible VUC encounters, classified by adult and pediatric VUC pilot sites, are shown in Table 1. Mean patient age was 28 years, 60% were female and 85% had a PCP. Most virtual visits were for low-acuity complaints and 70% were managed by the VUC provider without the need for emergent in-person emergency department assessment or referral elsewhere.

Of the 19 595 patient encounters linked to administrative data, 12.5% had an in-person emergency department visit within 72 hours and 21.5% had an in-person emergency department visit within 30 days of the index VUC visit; 2.1% had a hospital admission within 72 hours and 3.8% were admitted within 30 days of the index VUC visit (Table 2). There were few (< 0.03%, number suppressed to protect patient privacy) deaths within 30 days, none from the pediatric sites.

Of the 17 034 patients with a known VUC disposition, 2931 (17.2%) were referred to the emergency department (Table 1). Of those, 669 (22.8%) did not present to the emergency department within 72 hours of their VUC visit, but their 30-day emergency department visits were lower (14.3% v. 21.5%) and hospital admissions were similar (3.3% v. 3.8%) than those of the overall cohort (Appendix 3, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.230492/tab-related-content, and Table 2). Of the 2262 encounters with patients who were promptly referred to the emergency department by a VUC provider and presented to the emergency department within 72 hours, records from 2150 patients were available to be matched to provincial administrative databases. We matched 2129 (99.0%) to similar patients who presented to the emergency department in person. Results of the matched baseline characteristics are provided in Appendix 4A (available at www.cmaj.ca/lookup/doi/10.1503/cmaj.230492/tab-related-content). Baseline characteristics were well matched between groups. Although patients presenting to the emergency department in person were more likely to arrive by ambulance, index visit admissions, 30-day emergency department visits and hospital admissions were similar between groups (Table 3). Mean hospital length of stay was higher for patients who were referred to the emergency department by a VUC provider (7.5 d v. 5.1 d; Δ 2.4 d, 95% confidence interval [CI] 1.6 d to 3.2 d). Patients who initially sought VUC were more likely to have another VUC visit within 72 hours, 7 days and 30 days than patients who presented to the emergency department. They were also more likely to have a subsequent specialist visit within 7 days (24.0% v. 17.5%; Δ 6.5%, 95% CI 4.1% to 9.0%) and 30 days (48.6% v. 37.3%; Δ 11.3%, 95% CI 8.4% to 14.3%).

Of the 16 664 patient encounters who were seen by a VUC provider with no documented emergency department referral, records from 14 498 patients were available to be matched to provincial administrative databases (Appendix 2). We matched 14 179 (97.8%) to similar patients who presented to the emergency department in person and were discharged home. Results of the matched baseline characteristics are provided in Appendix 4B. Baseline characteristics were well matched between groups. Patients using VUC services were more likely to have an in-person emergency department visit within 72 hours (13.7% v. 7.0%; Δ 6.7%, 95% CI 6.1% to 7.5%), 7 days (16.5% v. 10.3%; Δ 6.2%, 95% CI 5.4% to 7.0%) and 30 days (21.9% v. 17.9%; Δ 4.0%, 95% CI 3.2% to 5.0%), but the percentage admitted to hospital within 72 hours (1.1% v. 1.3%; Δ −0.2%, 95% CI −0.5% to 0.0%) and 7 days (1.6% v. 1.9%; Δ −0.3%, 95% CI −0.6% to 0.0%) was similar to those presenting to the emergency department in person (Table 4). However, the percentage admitted to hospital within 30 days was greater for patients who visited the emergency department in person (3.4% v. 2.6%; Δ 0.8%, 95% CI 0.4% to 1.2%). Mean hospital length of stay was higher for patients initially presenting to VUC (6.2 d v. 5.2 d; Δ 1.0 d, 95% CI 0.7 d to 1.2 d). Few deaths (1–5) occurred in the VUC group, and no deaths occurred among matched patients. Deaths were not significantly different between groups.

The most common presenting complaints for patients who had a subsequent emergency department visit within 72 hours (Table 5) and 30 days (Table 6) after a VUC visit were fever and abdominal pain, with COVID-19 being the top known emergency department discharge diagnosis. The most common presenting complaints for patients who had a subsequent emergency department visit within 72 hours after an in-person emergency department visit were imaging tests and abnormal laboratory values and abdominal pain, with unspecified abdominal pain being the top known emergency department discharge diagnosis (Table 5).

Interpretation

We found that the overall impact of the provincial VUC pilot program on subsequent health care utilization was not significant. Patients referred promptly to the emergency department by a VUC provider had rates of health care utilization similar to

Table 1: Baseline demographic characteristics for all eligible virtual urgent care (VUC) records, classified by adult and pediatric VUC pilot sites*

Characteristic	No. (%) of patient encounters†		
	Adult *n* = 12 593	Pediatric *n* = 7002	Overall *n* = 19 595
Age, yr, mean ± SD	40.7 ± 19.3	3.9 ± 4.4	27.6 ± 23.6
Sex, female	8291 (65.8)	3419 (48.8)	11 710 (59.8)
Urban residents	12 183 (96.7)	6415 (91.6)	18 598 (94.9)
Neighbourhood income quintiles 4–5‡	4932 (39.2)	3586 (51.2)	8518 (43.5)
ON-Marg ethnic diversity quintiles 4–5‡	6778 (53.8)	3227 (46.1)	10 005 (51.1)
ON-Marg residential instability quintiles 4–5‡	5750 (45.7)	2460 (35.1)	8210 (41.9)
ON-Marg material deprivation quintiles 4–5‡	4779 (37.9)	1566 (22.4)	6345 (32.4)
ON-Marg dependency quintiles 4–5‡	3686 (29.3)	1700 (24.3)	5386 (27.5)
Asthma	3132 (24.9)	809 (11.5)	3941 (20.1)
Congestive heart failure	341 (2.7)	–	341 (1.7)
Hypertension	2702 (21.5)	–	2702 (13.8)
Chronic obstructive pulmonary disease	322 (2.6)	–	322 (1.6)
Diabetes	1456 (11.6)	28 (0.4)	1484 (7.6)
Dementia	189 (1.5)	–	189 (1.0)
Johns Hopkins ADGs			
0–4	3509 (27.9)	2576 (36.8)	6085 (31.0)
5–9	5421 (43.0)	3386 (48.4)	8807 (44.9)
10–14	2810 (22.3)	938 (13.4)	3748 (19.1)
≥ 15	853 (6.8)	102 (1.5)	955 (4.9)
Physician (PCP and specialists) visits in preceding 365 d, mean ± SD	11.40 ± 15.2	6.49 ± 6.8	9.64 ± 13.0
ED visits in preceding 365 d, mean ± SD	1.32 ± 4.1	0.86 ± 1.5	1.16 ± 3.4
Hospital admissions in preceding 365 d, mean ± SD	0.21 ± 0.8	0.31 ± 0.7	0.24 ± 0.8
No. of patients with PCP information reported	11 618	7002	18 620
Patient has PCP	9492 (81.7)	6291 (89.8)	15 783 (84.8)
No. of patients with acuity level§	4283	–	4283
Resuscitation (CTAS 1)	1–5**	–	1–5**
Emergent (CTAS 2)	279–283**	–	279–283**
Urgent (CTAS 3)	1061 (24.8)	–	1061 (24.8)
Less urgent (CTAS 4)	1030 (24.0)	–	1030 (24.0)
Nonurgent (CTAS 5)	1908 (44.5)	–	1908 (44.5)
No. of patients with VUC discharge disposition¶	10 800	6234	17 034
Discharged home	7461 (69.1)	4382 (70.3)	11 843 (69.5)
Referred to ED	1872 (17.3)	1059 (17.0)	2931 (17.2)
Referred to PCP	692 (6.4)	423 (6.8)	1115 (6.5)
Referred to specialist	573 (5.3)	90 (1.4)	663 (3.9)
Referred to COVID-19 or outpatient clinic	202 (1.9)	280 (4.5)	482 (2.8)

Note: ADGs = aggregated diagnosis groupings, CTAS = Canadian Triage and Acuity Scale, ED = emergency department, ON-Marg = Ontario Marginalization Index, PCP = primary care provider, SD = standard deviation.
*Adult sites were Lakeridge Health, Health Sciences North/Horizon Santé Nord, Sunnybrook Health Sciences Centre, St. Joseph's Healthcare Hamilton, Humber River Hospital, University Health Network, William Osler Health System, Thunder Bay Regional Health Sciences Centre and Unity Health Toronto. Pediatric sites were the Children's Hospital of Eastern Ontario, London Health Sciences Centre and SickKids.
†Unless otherwise specified.
‡Quintiles 4–5 represent the highest income, diversity, instability, deprivation and dependency.
§None of the pediatric VUC sites reported CTAS scores.
¶2561 missing disposition.
**Data in cells are suppressed to protect patient privacy.

Table 2: Health care utilization for all eligible virtual urgent care (VUC) records, classified by adult and pediatric VUC pilot sites*

Variable	No. (%) of patient encounters		
	Adult *n* = 12 593	Pediatric *n* = 7002	Overall *n* = 19 595
ED visit, in-person			
Within 72 h of index VUC visit	1609 (12.8)	835 (11.9)	2444 (12.5)
Within 7 d of index VUC visit	2019 (16.0)‡	1009 (14.4)	3028 (15.4)
Within 30 d of index VUC visit	2841 (22.6)‡	1382 (19.7)	4223 (21.5)
VUC revisit			
Within 72 h of index VUC visit	384 (3.0)‡	163 (2.3)	547 (2.8)
Within 7 d of index VUC visit	611 (4.8)‡	284 (4.1)	895 (4.6)
Within 30 d of index VUC visit	1050 (8.3)	550 (7.8)	1600 (8.2)
Hospital admission			
Within 72 h of index VUC visit	310 (2.5)‡	112 (1.6)	422 (2.1)
Within 7 d of index VUC visit	381 (3.0)‡	146 (2.1)	527 (2.7)
Within 30 d of index VUC visit	560 (4.4)‡	194 (2.8)	754 (3.8)
Primary care visit			
Visit on same day as index VUC visit†	6245 (49.6)‡	552 (7.9)	6797 (34.7)
Within 7 d of index VUC visit (excluding index date)	3661 (29.1)‡	935 (13.3)	4596 (23.4)
Within 30 d of index VUC visit (excluding index date)	6512 (51.7)‡	1851 (26.4)	8363 (42.7)
Specialist visit			
Visit on same day as index VUC visit†	284 (2.3)	5129 (73.2)‡	5413 (27.6)
Within 7 d of index VUC visit (excluding index date)	1996 (15.8)	1142 (16.3)	3138 (16.0)
Within 30 d of index VUC visit (excluding index date)	4583 (36.4)‡	2407 (34.4)	6990 (35.7)

Note: ED = emergency department.
*Adult sites were Lakeridge Health, Health Sciences North/Horizon Santé Nord, Sunnybrook Health Sciences Centre, St. Joseph's Healthcare Hamilton, Humber River Hospital, University Health Network, William Osler Health System, Thunder Bay Regional Health Sciences Centre and Unity Health Toronto; pediatric sites were the Children's Hospital of Eastern Ontario, London Health Sciences Centre and SickKids.
†For patients who saw a primary care provider or specialist on the same day as the VUC visit, it is not known which occurred first.
‡Indicates significant difference between the adult and pediatric cohorts.

those of patients who presented in person to the emergency department. Patients seen by a VUC provider with no further referral were more likely to have an in-person emergency department visit within 72 hours, 7 days and 30 days, and mean length of hospital admission was longer than for patients who presented to the emergency department in person and were discharged home. The presenting complaints for patients with subsequent emergency department visits appeared to be different between groups. Patients who presented to the emergency department in person and were discharged home returned more for diagnostic imaging and repeat blood work, while VUC patients may have had symptoms more likely to require an in-person assessment.

Virtual care may be an appropriate alternative health care option for patients who have non–life-threatening medical concerns such as minor injuries, coughs, colds and other illnesses that align with a list of best-practice conditions for virtual care.[12–17] It may also be a convenient option for patients who have difficulty accessing in-person health care, such as those who live in rural or remote areas or have mobility issues, those with no PCP or those who cannot access their PCP in a timely fashion.[18–20] Virtual care may also be appropriate for patients seeking guidance on whether an in-person emergency department visit is needed, but given the low acuity of presenting complaints, perhaps nurse practitioners, physician assistants or PCPs — as opposed to emergency physicians — may be better suited to provide these virtual services as part of a "primary care first" strategy, with the opportunity to escalate to a VUC emergency department physician for advice before recommending an in-person emergency department visit. This is especially true given the current crisis in emergency department staffing and severe emergency department workforce shortages.[21]

The services offered by VUC clinicians are inherently different from the in-person assessments their emergency department colleagues can provide, which may partially explain the subsequent greater health care utilization by patients seen by a VUC

Table 3 (part 1 of 2): Emergency department (ED) characteristics and health care utilization for virtual urgent care prompt referrals who presented to ED within 72 hours versus matched in-person controls

Variable	No. (%)* patients referred to ED by VUC *n* = 2129	No. (%)* of control patients who presented in person to ED *n* = 2129	Δ, %* (95% CI)
Arrival by ambulance	62 (2.9)	204 (9.6)	−6.7 (−8.1 to −5.2)
Acuity score			
Resuscitation (CTAS 1)	11 (0.5)	11–15§	NA
Emergent (CTAS 2)	365 (17.1)	423 (19.9)	−2.8 (−5.1 to −0.4)
Urgent (CTAS 3)	1242 (58.3)	1161 (54.5)	3.8 (0.9 to 6.8)
Less urgent (CTAS 4)	402 (18.9)	417 (19.6)	−0.7 (−3.1 to 1.7)
Nonurgent (CTAS 5)	109 (5.1)	114 (5.3)	−0.2 (−1.6 to 1.1)
Unknown	0 (0.0)	1–5§	NA
Top 5 CEDIS complaints			
Other (not top 5)	1427 (67.0)	1423 (66.8)	0.2 (−3.0 to 2.6)
Abdominal pain	234 (11.0)	240 (11.3)	−0.3 (−2.2 to 1.6)
Fever	210 (9.9)	204 (9.6)	0.3 (−2.1 to 1.5)
Upper extremity injury	107 (5.0)	108 (5.1)	−0.1 (−1.4 to 1.3)
Lower extremity injury	81 (3.8)	76 (3.6)	0.2 (−0.9 to 1.4)
Lower extremity pain	70 (3.3)	78 (3.7)	−0.4 (−1.5 to 0.7)
Procedures†			
No procedures	173 (8.1)	99 (4.6)	3.5 (2.0 to 5.0)
Diagnostic only	97 (4.6)	32 (1.5)	3.1 (2.0 to 4.1)
Laboratory only	0 (0.0)	1–5§	NA
Laboratory, therapeutic and diagnostic	25 (1.2)	22 (1.0)	0.2 (−0.8 to 0.5)
Therapeutic only	817 (38.4)	1045 (49.1)	−10.7 (−13.7 to −7.7)
Therapeutic and diagnostic	1017 (47.8)	931 (43.7)	4.1 (1.0 to 7.0)
Top 5 discharge diagnosis			
Other (not top 5)	1766 (82.9)	1807 (84.9)	−2.0 (−4.9 to 0.3)
Other and unspecified abdominal pain	94 (4.4)	88 (4.1)	0.3 (−1.5 to 0.9)
Fever, unspecified	84 (3.9)	71 (3.3)	0.6 (−0.5 to 1.7)
Urinary tract infection, site not specified	61 (2.9)	64 (3.0)	−0.1 (−0.9 to 1.2)
Chest pain, unspecified	72 (3.4)	47 (2.2)	1.2 (0.2 to 2.2)
COVID-19	52 (2.4)	52 (2.4)	0.0 (−0.9 to 0.9)
Discharge disposition			
Missing	11 (0.5)	20 (0.9)	−0.4 (−0.9 to 0.1)
Admitted	201 (9.4)	186 (8.7)	0.7 (−1.0 to 2.4)
Discharged	1902 (89.3)	1909 (89.7)	−0.4 (−2.2 to 1.5)
Transferred	15 (0.7)	14 (0.7)	0.0 (−0.5 to 0.5)

provider in this study. Virtual urgent care providers are not able to provide a comprehensive physical examination and may not have access to real-time laboratory tests, imaging and the patient's previous medical records, which may limit their ability to accurately diagnose certain conditions.[22–24] Future directions in the provision of virtual care should ensure that VUC providers have timely access (within 24 h) to outpatient laboratories and imaging, and the ability to connect with a practitioner in person, ideally with the patient's longitudinal PCP, especially for higher-acuity or higher risk–presenting complaints, or if an in-person physical examination is required. Timely access to in-person outpatient resources may help decrease subsequent health care utilization and reduce duplication at the system, regional and hospital levels.

Table 3 (part 2 of 2): Emergency department (ED) characteristics and health care utilization for virtual urgent care prompt referrals who presented to ED within 72 hours versus matched in-person controls

Variable	No. (%)* patients referred to ED by VUC *n* = 2129	No. (%)* of control patients who presented in person to ED *n* = 2129	Δ, %* (95% CI)
ED visit, in-person			
Within 72 h of index visit	149 (7.0)	166 (7.8)	−0.8 (−2.4 to 0.8)
Within 7 d of index visit	207 (9.7)	225 (10.6)	−0.9 (−2.7 to 1.0)
Within 30 d of index visit	362 (17.0)	372 (17.5)	−0.5 (−2.7 to 1.8)
VUC visit			
Within 72 h of index visit	51 (2.4)	0 (0.0)	2.4 (1.8 to 3.1)
Within 7 d of index visit	81 (3.8)	0 (0.0)	3.8 (3.1 to 4.7)
Within 30 d of index visit	142 (6.7)	0 (0.0)	6.7 (5.7 to 7.8)
Hospital admission			
Within 72 h of index visit	224 (10.5)	200 (9.4)	1.1 (−0.7 to 2.9)
Within 7 d of index visit	241 (11.3)	215 (10.1)	1.2 (−0.6 to 3.1)
Within 30 d of index visit	274 (12.9)	234 (11.0)	1.9 (−0.1 to 3.8)
Length of stay, d, mean ± SD	7.5 ± 17.5	5.1 ± 6.0	2.4 (1.6 to 3.2)
Primary care visits			
Visit on same day as index visit‡	654 (30.7)	248 (11.6)	19.1 (16.7 to 21.5)
Within 7 d of index visit (excluding index date)	523 (24.6)	498 (23.4)	1.2 (−1.4 to 3.7)
Within 30 d of index visit (excluding index date)	979 (46.0)	938 (44.1)	1.9 (−1.1 to 4.9)
Specialist visits			
Visit on same day as index visit‡	631 (29.6)	95 (4.5)	25.1 (23.0 to 27.3)
Within 7 d of index visit (excluding index date)	512 (24.0)	373 (17.5)	6.5 (4.1 to 9.0)
Within 30 d of index visit (excluding index date)	1035 (48.6)	794 (37.3)	11.3 (8.4 to 14.3)

Note: CTAS = Canadian Triage and Acuity Scale, CEDIS = Canadian Emergency Department Information System, CI = confidence interval, NA = not applicable, SD = standard deviation, VUC = virtual urgent care.
*Unless otherwise specified.
†Diagnostic refers to investigations such as diagnostic imaging or performing an electrocardiogram. Therapeutic refers to a procedure having been done or medication administered.
‡For patients who saw a primary care provider or specialist on the same day as the VUC visit, it is not known which occurred first.
§Data in cells are suppressed to protect patient privacy.

Similar to previous studies,[25–28] we found that patients accessing VUC services tended to be middle-aged, female, well-educated, predominantly English speaking, urban residents of high socioeconomic status, suggesting that there may be inequitable awareness of and access to VUC services. Users of VUC were younger than those accessing in-person emergency department care. Mean patient age for the adult VUC sites was 41 years, which is younger than the provincial average of 47 years.[29] We found that patients seen by a VUC provider and discharged home were more likely to have an in-person emergency department visit within 72 hours, 7 days and 30 days than those who presented directly to the emergency department. Lapointe-Shaw and colleagues found that virtual walk-in patients were less likely to have a follow-up in-person visit with the same physician, more likely to have another virtual visit, and twice as likely to visit the emergency department within 30 days of the initial virtual appointment.[26] In a retrospective study of more than 16 000 unique emergency department encounters, Shah and colleagues found that virtual follow-up visits after an emergency department discharge were associated with an increased rate of return emergency department visits and hospital admission within 30 days compared with in-person follow-up visits, even after adjusting for sociodemographic factors, acuity of illness and medical complexity.[24] The authors suggested that the increased health care utilization after virtual follow-up visits may be a result of the inherent limitation in the ability of virtual clinicians to physically examine patients, which may compel clinicians to have a lower threshold for referring patients back to the emergency department for an in-person evaluation if they have any ongoing symptoms.

Future research should attempt to identify quality-of-care indicators and best practices of virtual care as part of building a culture of continuous improvement. Similar to the Emergency Department Return Visit Quality Program,[30,31] future work should identify, audit and investigate underlying causes of subsequent health care utilization after a VUC visit and determine what needs to be addressed and changed, moving

Table 4: Health care utilization for patients seen by a virtual urgent care provider with no emergency department (ED) referral plus matched in-person ED controls who were discharged from the ED

Variable	No. (%)* of patients seen by VUC *n* = 14 179	No. (%)* of control patients discharged from in-person ED *n* = 14 179	Δ, %* (95% CI)
ED visit, in-person			
Within 72 h of index visit	1948 (13.7)	988 (7.0)	6.7 (6.1 to 7.5)
Within 7 d of index visit	2344 (16.5)	1460 (10.3)	6.2 (5.4 to 7.0)
Within 30 d of index visit	3111 (21.9)	2532 (17.9)	4.0 (3.2 to 5.0)
VUC visit			
Within 72 h of index visit	357 (2.5)	0 (0.0)	2.5 (2.2 to 2.8)
Within 7 d of index visit	569 (4.0)	0 (0.0)	4.0 (3.7 to 4.4)
Within 30 d of index visit	993 (7.0)	0 (0.0)	7.0 (6.6 to 7.4)
Hospital admission			
Within 72 h of index visit	151 (1.1)	187 (1.3)	−0.2 (−0.5 to 0.0)
Within 7 d of index visit	221 (1.6)	268 (1.9)	−0.3 (−0.6 to 0.0)
Within 30 d of index visit	370 (2.6)	479 (3.4)	−0.8 (−1.2 to −0.4)
Length of stay, d, mean ± SD	6.2 ± 10.4	5.2 ± 9.3	1.0 (0.7 to 1.2)
Primary care visits			
Visit on same day as index visit†	5089 (35.9)	1651 (11.6)	24.3 (23.3 to 25.2)
Within 7 d of index visit (excluding index date)	3173 (22.4)	3242 (22.9)	−0.5 (−1.5 to 0.5)
Within 30 d of index visit (excluding index date)	5837 (41.2)	6134 (43.3)	−2.1 (−3.2 to 0.9)
Specialist visits			
Visit on same day as index visit†	3748 (26.4)	715 (5.0)	21.4 (20.6 to 22.2)
Within 7 d of index visit (excluding index date)	1996 (14.1)	2368 (16.7)	−2.6 (−3.5 to −1.8)
Within 30 d of index visit (excluding index date)	4537 (32.0)	4757 (33.5)	−1.5 (−2.6 to −0.5)

Note: CI = confidence interval, SD = standard deviation, VUC = virtual urgent care.
*Unless otherwise specified.
†For patients who saw a primary care provider or specialist on the same day as the VUC visit, it is not known which occurred first.

forward, and learn from the successes and challenges of the initial pilot program. We previously asked each VUC program lead to describe their local pilot initiative, share facilitators and barriers to adoption of VUC services, and summarize lessons learned for future VUC design and development.[9] Common facilitators included local champions to guide VUC program delivery, provincial funding support, incorporating patients throughout the planning process, and multimodal marketing and promotions. Common barriers included behaviour change strategies to support adoption of a new service; access to high-quality information technology to support new workflow models that consider privacy, risk and legal perspectives; and standardized data collection to support overall objective impact assessments. Although the heterogeneity of program implementation respected local autonomy, it also presented challenges for sustainability efforts and future funding considerations. Future research should engage community members from vulnerable populations to determine strategies to improve awareness and uptake of virtual care among equity-deserving and underserved populations, especially in rural and remote communities where access to health care is more challenging. Researchers may also wish to examine what data should be collected to help inform VUC models, moving forward, to achieve the correct balance between virtual and in-person care that optimizes overall access, quality and value for money.

Limitations

Patients who use VUC services seem to be inherently different from patients who present in person to the emergency department. We decided to split the cohort of patients using VUC services into those promptly referred to the emergency department for in-person care and those who saw a VUC provider with no documented referral to the emergency department. We included 2561 VUC encounters that had a missing discharge disposition in our "No emergency department referral" cohort, but it is possible that some of these patients may have been referred to the emergency department by the VUC provider during their initial VUC visit. Therefore, we may have underestimated the

Table 5: Characteristics of patients who visited the emergency department (ED) within 72 hours after being seen by virtual urgent care without an ED referral compared with patients discharged home after an in-person ED visit

Characteristic	No. (%) of patients seen by VUC *n* = 1948	No. (%) of patients with in-person ED visit *n* = 988	Δ, % (95% CI)
Arrival by ambulance	112 (5.6)	62 (6.3)	−0.7 (−2.5 to 1.2)
Acuity score			
Resuscitation (CTAS 1)	12 (0.6)	6–10*	NA
Emergent (CTAS 2)	346 (17.8)	131 (13.3)	4.5 (1.7 to 7.2)
Urgent (CTAS 3)	1113 (57.1)	534 (54.0)	3.1 (−0.7 to 6.9)
Less urgent (CTAS 4)	367 (18.8)	231 (23.4)	−4.6 (−7.8 to −1.4)
Nonurgent (CTAS 5)	110 (5.6)	85 (8.6)	−3.0 (−5.1 to −1.0)
Unknown	0 (0.0)	1–5*	NA
Top 5 CEDIS complaints			
Other (not top 5)	1383 (71.0)	625 (63.3)	7.7 (4.1 to 11.4)
Fever	242 (12.4)	63 (6.4)	6.0 (3.8 to 8.1)
Abdominal pain	201 (10.3)	56 (5.7)	4.6 (2.6 to 6.6)
Imaging tests	38 (1.9)	116 (11.7)	−9.8 (−12.0 to −7.8)
Abnormal laboratory values	22 (1.1)	88 (8.9)	−7.8 (−9.7 to −6.1)
Rash	62 (3.2)	40 (4.0)	−0.8 (−2.4 to 0.5)
Procedures			
No procedures	77 (3.9)	60 (6.1)	−2.2 (−4.0 to −0.5)
Diagnostic only	29 (1.5)	21 (2.1)	−0.6 (−1.8 to 0.3)
Laboratory only	0 (0.0)	1–5*	NA
Laboratory, therapeutic and diagnostic	26 (1.3)	11 (1.1)	0.2 (−0.7 to 1.0)
Therapeutic only	970 (49.8)	507 (51.3)	−1.5 (−5.3 to 2.3)
Therapeutic and diagnostic	846 (43.4)	389 (39.4)	4.0 (0.3 to 7.8)
Top 5 discharge diagnosis			
Other (not top 5)	1598 (82.0)	858 (86.8)	−4.8 (−7.5 to 2.0)
Other and unspecified abdominal pain	75 (3.8)	47 (4.8)	−1.0 (−2.6 to 0.6)
Fever, unspecified	72 (3.7)	29 (2.9)	0.8 (−0.7 to 2.1)
COVID-19	82 (4.2)	15 (1.5)	2.7 (1.4 to 3.8)
Urinary tract infection, site not specified	61 (3.1)	23 (2.2)	0.9 (−0.5 to 2.0)
Viral infection, unspecified	60 (3.1)	16 (1.6)	1.5 (0.3 to 2.5)
Discharge disposition			
Missing	16 (0.8)	9 (0.9)	−0.1 (−0.9 to 0.6)
Admitted	135 (6.9)	119 (12.0)	−5.1 (−7.9 to −2.9)
Discharged	1786 (91.7)	854 (86.4)	5.3 (2.9 to 7.8)
Transferred	11 (0.6)	6 (0.6)	0.0 (−0.8 to 0.7)

Note: CI = confidence interval, CEDIS = Canadian Emergency Department Information System, CTAS = Canadian Triage and Acuity Scale, NA = not applicable, VUC = virtual urgent care.
*Data in cells are suppressed to protect patient privacy.

differences in 72-hour, 7-day and 30-day emergency department visits between groups. Although we matched on many important baseline characteristics, there may be some variables (e.g., acuity score) not included in our propensity score match that could be related both to a decision to use VUC and to outcomes, so the risk of residual confounding remains. The generalizability of our results to populations with different demographics is uncertain. In addition, patients using VUC

Table 6: Characteristics of patients who visited the emergency department (ED) within 30 days after being seen by virtual urgent care without an ED referral compared with patients discharged home after an in-person ED visit

Characteristic	No. (%) of patients seen by VUC *n* = 3111	No. (%) of patients with in-person ED visit *n* = 2532	Δ, % (95% CI)
Arrival by ambulance	235 (7.5)	224 (8.8)	−1.3 (−2.7 to 0.1)
Acuity score			
Resuscitation (CTAS 1)	16–20*	16–20*	NA
Emergent (CTAS 2)	548 (17.6)	441 (17.4)	0.2 (−1.8 to 2.2)
Urgent (CTAS 3)	1767 (56.8)	1319 (52.1)	4.7 (2.1 to 7.3)
Less urgent (CTAS 4)	599 (19.2)	517 (20.4)	−1.2 (−3.3 to 0.9)
Nonurgent (CTAS 5)	176 (5.7)	234 (9.2)	−3.6 (−5.0 to −2.2)
Unknown	1–5*	1–5*	NA
Top 5 CEDIS complaints			
Other (not top 5)	2197 (70.6)	1862 (73.5)	−2.9 (−5.3 to −0.6)
Abdominal pain	306 (9.8)	187 (7.4)	2.4 (1.0 to 3.9)
Fever	316 (10.2)	157 (6.2)	4.0 (2.5 to 5.4)
Shortness of breath	144 (4.6)	85 (3.4)	1.5 (0.3 to 2.3)
Rash	105 (3.4)	100 (3.9)	−0.5 (−1.6 to 0.4)
Imaging tests	43 (1.4)	141 (5.6)	−4.2 (−5.2 to −3.2)
Procedures			
No procedures	127 (4.1)	175 (6.9)	−2.8 (−4.1 to −1.6)
Diagnostic only	46 (1.5)	38 (1.5)	0.0 (−0.6 to 0.6)
Laboratory only	0 (0.0)	1–5*	NA
Laboratory, therapeutic and diagnostic	47 (1.5)	32 (1.3)	0.2 (−0.4 to 0.9)
Therapeutic only	1599 (51.4)	1334 (52.7)	−1.3 (−3.9 to 1.3)
Therapeutic and diagnostic	1292 (41.5)	953 (37.6)	3.9 (1.3 to 6.4)
Top 5 discharge diagnosis			
Other (not top 5)	2606 (83.8)	2218 (87.6)	−3.8 (−5.6 to −2.0)
Other and unspecified abdominal pain	119 (3.8)	99 (3.9)	−0.1 (−1.1 to 0.9)
COVID-19	116 (3.7)	50 (2.0)	1.7 (0.9 to 2.6)
Fever, unspecified	92 (3.0)	65 (2.6)	0.4 (−0.5 to 1.2)
Urinary tract infection, site not specified	82 (2.6)	63 (2.5)	0.1 (−0.7 to 0.9)
Viral infection, unspecified	96 (3.0)	37 (1.5)	1.5 (0.8 to 2.4)
Discharge disposition			
Missing	264 (8.5)	329 (13.0)	−4.5 (−6.2 to −2.9)
Admitted	14 (0.4)	24 (1.0)	−0.6 (−1.0 to −0.1)
Discharged	2813 (90.4)	2149 (84.9)	5.5 (3.8 to 7.3)
Transferred	20 (0.6)	30 (1.2)	−0.6 (−1.1 to 0.0)

Note: CI = confidence interval, CEDIS = Canadian Emergency Department Information System, CTAS = Canadian Triage and Acuity Scale, NA = not applicable, VUC = virtual urgent care.
*Data in cells are suppressed to protect patient privacy.

services in 1 geographic location may share a similar health care pathway and may be more alike than patients in other locations and different care pathways. We documented the physician visits associated with the index day, but we did not have access to the exact time of the VUC or in-person emergency department visit and, as such, temporality is unknown between the primary care visit, specialist visit and VUC visit. The physician categories in OHIP billing data are not always clearly

defined or standardized, which may lead to inconsistent categorization across different health care providers or even the same provider. Some VUC providers may have been misclassified as a PCP or as a specialist (e.g., pediatrician). We also do not know if the VUC users would have attended an emergency department in the absence of VUC. They may have waited to access their PCP, a walk-in clinic or other health care service. Future work should compare the health care expenditures of VUC to these alternative services. It is not clear if there was a difference in health care utilization dependent on mode of VUC delivery (video v. phone) or initial screening process (self-screening v. triage nurse). Finally, the VUC patient encounters included in this study were from a 10-month period early in the COVID-19 pandemic. Therefore, our findings may not be generalizable to VUC services or health care utilization outside the study period.

Conclusion

We found no overall impact of the provincial VUC pilot program on both subsequent emergency department visits and hospital admissions, although an important percentage of VUC patients subsequently attended an emergency department in person. These findings highlight the need to better understand the inherent limitations of virtual care and ensure future VUC providers have timely access to in-person outpatient resources for follow-up, to reduce subsequent emergency department visits and ensure appropriate use of emergency department services.

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