BMC Public Health

RESEARCH Open Access

Reaching the "Last Mile": describing community clinics implemented to increase COVID-19 vaccine uptake in Peel region, Canada

Jannice So[1*], Dannielle Nicholson-Baker[1], Subrana Rahman[2], Nancy Ramuscak[1], Anthony Reid[3], Monali Varia[1], Nazia Peer[1,4], Elizabeth Estey Noad[1], Sondra Davis[1], Shaza A. Fadel[2] and Erica Di Ruggiero[2,5]

Abstract

Background COVID-19 hit Canada hard and exacerbated health inequities, notably among ethnoracially minoritized populations. By August 2021, some areas in Peel region (Ontario, Canada) continued to have high COVID-19 infection rates and low COVID-19 vaccine coverage. To increase first dose uptake, Peel Public Health implemented smaller community-based vaccination clinics in addition to pre-existing mass vaccination (fixed) clinics. This study describes these community clinics and those who received their first dose at a community clinic to determine whether local public health efforts to implement community clinics reached different population groups and whether these community clinics contributed to an increase in uptake of the first dose of COVID-19 vaccines.

Methods We conducted a descriptive, cross-sectional study using data from the Ontario COVID-19 vaccination registry (COVaxON). We included eligible Peel residents 12 years and older who received a COVID-19 vaccine within community and fixed clinics between September 2021 and August 2022. Clinics were classified based on clinic type (community/fixed), and location. COVID-19 vaccine uptake for smaller geographic areas designated by postal codes was calculated at the beginning and end of the study period. Clinic and attendee characteristics were analyzed using descriptive statistics.

Results There were 177 community and 11 fixed clinic sites that operated during the study period. Community clinics administered 98,965 doses (27%) of COVID-19 vaccine and fixed clinics administered 264,021 doses (73%). A slightly higher proportion of first doses were administered in community clinics (8.1%) compared to fixed clinics (7.9%) and community clinics saw a higher proportion of first dose recipients from low-coverage areas (23% versus 19% in fixed clinics). Clinics in faith-based organizations, schools and shopping areas administered the most doses among community clinic locations. The absolute increase in first dose vaccine uptake was 11% over the study period.

*Correspondence:
Jannice So
jannice.so@peelregion.ca

Full list of author information is available at the end of the article

Conclusions Almost 100,000 doses of COVID-19 vaccine were administered in community clinics, which contributed to increased overall vaccine coverage in Peel region. A slightly higher proportion of first doses were administered in community clinics compared to fixed clinics and a higher proportion of doses to residents of low-coverage areas.

Keywords COVID-19, COVID-19 vaccines, Mass vaccination, Immunization programs, Community health services, Access to care, Vaccine hesitancy, SORT IT

Background

Throughout the COVID-19 pandemic, Peel region was identified as one of Canada's hardest-hit regions, reporting one of the highest COVID-19 incidence rates nationwide [1]. This burden was particularly significant among ethnoracially minoritized populations, who may have experienced systemic racism, which has been associated with challenges in accessing healthcare and fostering trust in institutions during public health crises [2, 3, 4]. In culturally diverse communities, such as Peel's, there are several factors that influence vaccination uptake, including ethnicity, religion, and language [5]. These factors can contribute to vaccine hesitancy, which is the delay in acceptance or refusal of vaccines despite their availability [6, 7]. Vaccine hesitancy is also influenced by convenience of access and the quality of vaccination services [8]. Increasing access to vaccines can address these factors and help build trust in the vaccine's effectiveness and safety, leading to reduced vaccine hesitancy [9]. Recognizing these complex and interwoven factors, tailored approaches became imperative to ensure that the planning and delivery of COVID-19 interventions was equitable.

In Canada, the health system is administered by the provincial government through the Ministry of Health. Public health policies, initiatives, and programs are determined at the provincial level, with local public health units in the province of Ontario responsible for implementation and service delivery [10]. With the provincial Ministry of Health, local public health unit actions include promoting vaccination programs, coordinating vaccination clinics, and distributing vaccines [11].

In Ontario, COVID-19 vaccination efforts began at the end of 2020 with local public health units across Ontario being responsible for vaccine management and distribution (Fig. 1). Vaccine eligibility gradually expanded from highest-risk groups towards the general population, with the general population aged 12 + years becoming all eligible for the vaccine as of May 2021. The Ministry of Health set a target of least 90% first dose COVID-19 vaccine uptake for those who were eligible by November 2021, with the aim of increasing COVID-19 vaccination coverage across Ontario [12]. As vaccines became available in Peel region, they were administered first at hospital-based clinics and later in mass vaccination sites in locations that allowed for efficient vaccination of large numbers of people, such as sports centres, malls, and convention centres (i.e., fixed clinics in Box 1). By August 2021, 82% of the Ontario population (12 years and older) had received at least one dose of COVID-19 vaccine [13].

Despite this progress, certain regions in Ontario, notably ethnically diverse and minoritized areas, continued to exhibit low vaccination rates [14]. Recognizing this challenge, the province introduced the "Last Mile Strategy" to reach the remaining eligible population [13]. The province worked with local public health units to identify geographic areas with low vaccination rates based on postal codes [13]. This information, along with information about areas with ongoing high rates of COVID-19 transmission, severe illness and death, was used to identify geographic areas for enhanced vaccination efforts [15].

Within Peel region, the "Last Mile Strategy" was implemented in September 2021 with the primary emphasis on improving uptake of first doses in communities and groups with lower vaccine coverage through smaller, community-based clinics alongside continued fixed clinic sites (Fig. 1). Peel Public Health, the region's public health unit, shared quantitative data for decision-making with trusted faith leaders and community partners, who in turn provided contextual information about why people were not going to established clinics to Peel Public Health. The collaborative approach allowed for co-designing and implementing community clinics where the community was living, working and/or commuting (Box 1).

These community clinics implemented a range of strategies to increase vaccine confidence, accessibility, and awareness. Community clinics in faith-based organizations allowed for outreach and communication through trusted faith leaders and those who were members of the faith communities. Community clinics applied culturally responsive and tailored approaches to support minoritized groups to increase the sense of comfort for attendees such as through offering of familiar food and music. School buildings were used as community clinic locations because they are distributed throughout residential areas in Peel region and were thought to be familiar settings for most local families. Community clinics in shopping areas were intended to increase convenience through locations where Peel residents would be for normal daily activities such as grocery and shopping. The requirement for providing proof of permanent Ontario residence was removed to create opportunities for non-permanent

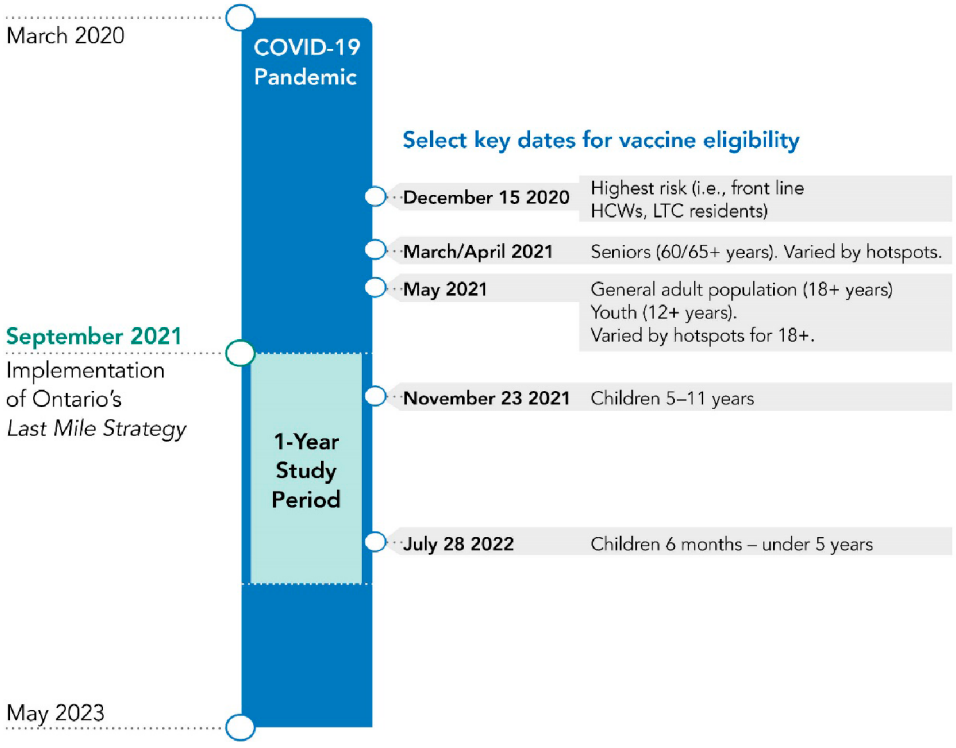

Fig. 1 Timeline of COVID-19 pandemic, select vaccine eligibility dates and study period for Peel region. Note: HCWs = healthcare workers; LTC = long-term care. Adapted from Fitzpatrick, T., Allin, S., Camillo, C.A., Habbick, M., Mauer-Vakil, D., Muhajarine, N., Roerig, M., & Rowein, S. (2022). COVID-19 Vaccination Rollout: Ontario. CoVaRR-Net and North American Observatory on Health Systems and Policies. COVID-19 Vaccination Rollout Monitor

Box 1 Definition of COVID-19 Vaccination Clinic Type

Clinic Type Definitions

Fixed Clinics: Mass vaccination clinics aimed at providing COVID-19 vaccinations to the general population, regardless of demographic factors, that remained open for the duration of the pandemic in Peel region.

Community Clinics: Smaller, community-oriented clinics that focused on bringing vaccines directly to people who had not yet received a dose or completed their series of COVID-19 vaccination in environments that were convenient, supportive, and/or familiar. Clinic site selection and set-up considered low vaccination coverage and/or large numbers of under-vaccinated individuals, cultural, socioeconomic and/or geographic factors to reduce barriers to vaccinations. The clinic sites were often temporary and were located across Peel region as informed by ongoing collaboration with community partners and local data.

residents, such as international students, to access vaccinations. Plain clothes security guards and greeters that were trusted community members were situated within the clinics with aims to overcome fear and barriers resulting from historical mistrust and negative experiences the communities had with police. Community ambassadors went door-to-door in specific residential buildings to provide awareness, answer questions, and schedule appointments, which aimed to address barriers with using the provincial online booking system and lack of internet access.

In this study, we aimed to describe community clinics and those 12 years and older who received their first dose at a community clinic over the one-year period post-implementation to determine whether local public health efforts reached different population groups and whether these community clinics contributed to an increase in uptake of the first dose of COVID-19 vaccines. Our specific objectives were to: (1) describe the characteristics of the community clinics from September 2021 to August 2022; (2) compare the proportion of first doses administered at community versus fixed clinics; (3) describe characteristics of individuals who received their first dose at community clinics versus those who received their first dose at fixed clinics; and (4) quantify the change in first dose coverage over the study period.

Methods

Setting

The study was conducted in Peel region, which is a suburban area located directly west of Toronto, Ontario, Canada. Peel's population of 1.45 million is distributed across three municipalities, the Cities of Mississauga (49%) and Brampton (45%) and the Town of Caledon (5%). Peel residents are ethnically diverse with 67% of residents self-identifying with a racialized group [16]. Forty-four per cent of Peel residents identify as Christian, 13%

Hindu, 13% Muslim, 14% Sikh, 15% secular and 2% other religious affiliations. After English or French (official languages in Canada), Punjabi is the most common language spoken at home [17]. Fifty-two per cent of Peel residents are immigrants to Canada [17].

Study design

This is a descriptive, cross-sectional study using COVID-19 vaccination records extracted from Ontario Ministry of Health's provincial COVID-19 vaccination registry (COVaxON), as of May 28, 2024. COVaxON is a registry of all COVID-19 vaccinations administered in Ontario and captures basic client demographics (e.g., date of birth, gender, client address), vaccination information, and location of vaccine dose administered. Peel Public Health has authority to access vaccination information within COVaxON under the Ontario *Health Protection and Promotion Act* for the purpose of service provision, program evaluation and quality improvement.

Ethics and consent

Individuals who sought to be vaccinated at one of Peel Public Health's clinics were required to consent to vaccination and were provided with the option to consent to data collected within COVaxON. For those individuals who were deemed incapable of consenting, consent was obtained from a parent/guardian. A total of 866,041 doses of COVID-19 vaccines were administered to Peel residents aged 12 + years within Peel region during the study period. Thirty-one (0.0036%) doses did not have a recorded consent for data collection within COVaxON.

Description of dataset

We included Peel residents aged 12 years and older who had a recorded consent to COVaxON data collection and received their COVID-19 vaccination within a community or fixed clinic in Peel region between September 1, 2021 and August 30, 2022. Residents and clinics were identified as being located within Peel based on whether the health unit categorization of vaccination in COVaxOn was "Peel Public Health".

To focus our analysis on the vaccination clinics implemented by local public health, we excluded Peel residents who received their COVID-19 vaccinations from: (1) a clinic not opened to the general public (outbreak/workplace clinics, congregate settings, and vaccinations that occurred in an individual's home); and (2) clinics administered by other healthcare providers in locations that were not created specifically for delivery of COVID-19 vaccinations (pharmacies and primary health care settings). Of the 866,010 clients who consented, 26,247 (3%) doses were administered within clinics not opened to the general public and 476,777 (55%) doses were administered within pharmacies and primary health care settings. As a result, 362,986 COVID-19 vaccination records were included for analysis.

COVID-19 vaccination records included date of birth, gender, immunization date, dose number, client postal code, and vaccination event name where the dose was administered (which included the clinic name). COVID-19 vaccination records within COVaxON were routinely monitored for quality and remediated, as needed, by Peel Public Health. Client vaccination data were de-duplicated based on client name, date of birth and additional doses received on the same date, which were assumed to be data entry errors. Age at time of vaccination was calculated using date of birth and immunization date. Day of the week was extracted from immunization date and categorized into weekday (Monday-Friday) or weekend (Saturday-Sunday). Client and clinic municipalities (Brampton, Caledon or Mississauga) were derived by matching client residential and clinic postal codes to their respective municipality using the Postal Code Conversion File from Canada Post (version December 2023 matched to the 2021 Canadian census).

The "vaccination event name" variable within COVaxON captured details related to both the clinic type and clinic location. Event names were cleaned and de-duplicated to identify unique clinic sites that operated during the study period. A clinic was defined as operational on a given day if at least one dose of COVID-19 vaccine was administered that day. Clinic type (community/fixed) and clinic location were classified by the study team based on vaccination event names, classification within COVaxON, community clinic planning data, and/or internet search. Based on the types of services provided, community clinic location was divided into eight groupings: community centre, faith-based organization, post-secondary institution, publicly-funded school (elementary), publicly-funded school (secondary), shopping areas (malls, plazas and parking lots of shopping areas), service organizations (employment, mental health, newcomer, children, and specialty treatment services, and foodbanks) and other location types (e.g., special events, parks, train station).

Key measures and definitions

The measures used to compare community and fixed clinics were:

Total number of clinic operating days

calculated by summing the number of clinic sites operating each day across the study period. This measure was used as a proxy for clinic availability in the absence of data on clinic operating hours.

Average number of doses administered (for first dose/any dose number) per clinic operating day

calculated by dividing the total number of COVID-19 doses (for first dose/any dose number) by total number of clinic operating days.

Median distance from residence to clinic

Euclidean distances were calculated using "Generate Origin-Destination Link" tool in ArcGIS Pro 2.9.6, which calculated straight-line distance from client residential postal codes to clinic postal codes; it did not follow real-world travel routes and was an estimation of distance between points.

Initial vaccination coverage

Peel region was subdivided into smaller geographical areas based on forward sortation areas (FSA), which are the first three digits of the Canadian postal code and used as a standard geographic boundary for analysis. At the start of the study, first dose vaccine coverage was calculated for each FSA based on the number of first doses administered as of August 30, 2021 to those 12 + years of age divided by total population (12+) in the FSA. Population data by FSA were extracted from the Ontario Health Insurance Plan Registered Persons Database. An FSA was considered to have low initial COVID-19 first dose coverage if the coverage ranked in the lowest tertile across the 32 residential FSAs in Peel region.

Change in vaccination coverage

Change in first dose COVID-19 vaccine coverage was measured based on the absolute increase in first dose vaccination coverage for those aged 12 + years at the beginning of the study period (August 30, 2021) and the end of the study period (August 28, 2022) based on FSA.

Analysis methods

We conducted data cleaning and analysis using Microsoft Excel 365, ArcGIS Pro 2.9.6 and Stata 17.0 applications. Descriptive statistics of data variables were performed across clinic type (community/fixed) and across community clinic locations. Given that COVaxON is a population-level registry of all COVID-19 vaccinations administered within Ontario, no inferential statistics were calculated as observed differences between groups are true differences in the population.

Results

Table 1 summarizes the characteristics of COVID-19 vaccine clinics and doses administered to Peel residents 12 years and older. A total of 177 community clinic sites and 11 fixed clinic sites operated in Peel region during the study period. The highest number of community clinics were located in elementary and secondary schools. Median duration of operation of a community clinic site was 3 days, with one community clinic site located in a faith-based organization operating 267 days out of the one-year period.

Community clinics had 1,445 clinic operating days (42%) and fixed clinics had 1,997 (58%) clinic operating days during the study period. Of the 1,445 community clinic operating days, 363 days (25%) were in secondary schools, 327 days (22%) were in faith-based organizations, and 222 days (15%) were in shopping areas. Most faith-based organization clinics were located within Brampton, whereas most clinics in shopping areas were located in Mississauga. A higher proportion of community clinics were held on weekends and in areas of low initial vaccine coverage compared to fixed clinics (28% versus 19% and 27% versus 17%, respectively). The majority of community clinics located in shopping areas and service organizations were held in areas that had low initial vaccine coverage (56% and 64%, respectively).

Community clinics administered 98,965 total doses (27%) and fixed clinics administered 264,021 total doses (73%) of COVID-19 vaccine during the study period. Of the total doses administered within each clinic type, a slightly higher proportion of first doses were administered in community clinics (8.1%) than fixed clinics (7.9%). Community clinics located in post-secondary institutions, service organizations, and faith-based organizations administered greater proportions of first doses than fixed clinics (17.2%, 11.7% and 10.9%, respectively, versus 7.9%).

Clinics within faith-based organizations administered 4,252 first doses and administered higher average number of first doses per operating day (13 first doses per operating day) than other community clinic types or fixed clinics.

Table 2 includes first doses client characteristics within community clinics and fixed clinics and across community clinic locations. There were no notable differences comparing all community clinics to fixed clinic attendance by age, gender or municipality of residence, though differences across age and municipality of residence were observed among some community clinic locations compared to fixed clinics. Community clinics in elementary and secondary schools had greater proportions of first dose clients aged 12–17 years than other community clinic locations or fixed clinics. Community clinics had a greater proportion of first dose clients from areas of low initial vaccine coverage than fixed clinics (23% versus 19%), especially for community clinics located in shopping areas (84%), service organizations (80%) and elementary schools (73%). After adjusting for the clinic operating days (i.e., calculating average number of first doses administered per clinic operating day), we continued to observe differences in first dose client

Table 1 Clinic description and doses administered by clinic type, September 2021 to August 2022, Peel region

	Community Clinics by Clinic Location									Fixed Clinics
	Faith-Based Organization	School (Secondary)	Shopping Area	School (Elementary)	Community Centre	Service Organization	Post-Secondary Institution	Other Location Types	All	
COVID-19 vaccine clinic description										
Number of clinic sites	19	44	15	45	13	13	3	25	177	11
Median days in operation per clinic site (range)	2 (1-267)	5 (1–26)	2 (1–96)	3 (1–16)	4 (1–48)	2 (1–18)	5 (3–24)	1 (1–52)	3 (1-267)	164 (24–282)
Total number of clinic operating days*	327	363	222	195	97	64	32	145	1445	1997
Distribution of clinic operating days*	**N = 327 (%)**	**N = 363 (%)**	**N = 222 (%)**	**N = 195 (%)**	**N = 97 (%)**	**N = 64 (%)**	**N = 32 (%)**	**N = 145 (%)**	**N = 1445 (%)**	**N = 1997 (%)**
Clinic Municipality										
Brampton	289 (88)	162 (45)	7 (3)	68 (35)	75 (77)	20 (31)	27 (84)	5 (3)	653 (45)	682 (34)
Caledon	0 (0)	23 (6)	0 (0)	6 (3)	0 (0)	0 (0)	0 (0)	1 (1)	30 (2)	267 (13)
Mississauga	34 (10)	178 (49)	215 (97)	121 (62)	22 (23)	43 (67)	5 (16)	20 (14)	638 (44)	1048 (52)
Unknown	4 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	119 (82)	124 (9)	0 (0)
Day of the Week										
Weekday	215 (66)	238 (66)	190 (86)	145 (74)	87 (90)	29 (45)	25 (78)	110 (76)	1039 (72)	1626 (81)
Weekend	112 (34)	125 (34)	32 (14)	50 (26)	10 (10)	35 (55)	7 (22)	35 (24)	406 (28)	371 (19)
Initial first dose COVID-19 vaccine coverage in the area where the clinic was located**										
Low	10 (3)	110 (30)	125 (56)	83 (43)	20 (21)	41 (64)	0 (0)	8 (6)	397 (27)	344 (17)
Not low	296 (91)	253 (70)	97 (44)	112 (57)	77 (79)	22 (34)	32 (100)	14 (10)	903 (62)	1586 (79)
Unknown	21 (6)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	123 (85)	145 (10)	67 (3)
COVID-19 vaccine doses administered										
Number of first doses administered	4252	1452	885	361	349	269	221	258	8047	20,777
Total number of doses administered	39,117	20,160	14,358	9660	8281	2306	1283	3800	98,965	264,021
Proportion of doses administered that were first doses	10.9%	7.2%	6.2%	3.7%	4.2%	11.7%	17.2%	6.8%	8.1%	7.9%
Average number of first doses administered per clinic operating day	13	4	4	2	4	4	7	2	6	10
Average number of doses (any dose number) administered per clinic operating day	120	56	65	50	85	36	40	26	68	132

* Clinic operating days were the total number of clinics in operation each day over the study period. A clinic in operation was defined as a clinic that had administered at least one dose of COVID-19 vaccine (regardless of dose number) that day

** Coverage was classified as "low" if first dose COVID-19 vaccine coverage among aged 12 years and older of the respective forward sortation area (FSA) on August 30, 2021 ranked in the lowest tertile across the 32 residential FSAs in Peel region. FSAs ranked in the middle and highest tertiles were classified as "not low"

Table 2 First dose client characteristics by clinic type, September 2021 to August 2022, Peel region

	Community Clinics by Clinic Location									Fixed Clinics
	Faith-Based Organization	School (Secondary)	Shopping Area	School (Elementary)	Community Centre	Service Organization	Post-Secondary Institution	Other Location Types	All	
First dose clients	***N*** **= 4252 (%)**	***N*** **= 1452 (%)**	***N*** **= 885 (%)**	***N*** **= 361 (%)**	***N*** **= 349 (%)**	***N*** **= 269 (%)**	***N*** **= 221 (%)**	***N*** **= 258 (%)**	***N*** **= 8047 (%)**	***N*** **= 20,777 (%)**
Age Group, years										
12–17	671 (16)	675 (46)	127 (14)	170 (47)	77 (22)	35 (13)	26 (12)	68 (26)	1849 (23)	3958 (19)
18–29	1773 (42)	260 (18)	270 (31)	63 (17)	100 (29)	79 (29)	102 (46)	79 (31)	2726 (34)	7084 (34)
30–49	1348 (32)	370 (25)	306 (35)	88 (24)	107 (31)	95 (35)	60 (27)	77 (30)	2451 (30)	6508 (31)
50–69	389 (9)	130 (9)	156 (18)	32 (9)	50 (14)	49 (18)	32 (14)	27 (10)	865 (11)	2757 (13)
70+	71 (2)	17 (1)	26 (3)	8 (2)	15 (4)	11 (4)	1 (0)	7 (3)	156 (2)	470 (2)
Gender										
Female	1762 (41)	714 (49)	420 (47)	177 (49)	159 (46)	100 (37)	93 (42)	124 (48)	3549 (44)	9716 (47)
Male	2490 (59)	738 (51)	464 (52)	184 (51)	190 (54)	169 (63)	128 (58)	134 (52)	4497 (56)	11,056 (53)
Non-binary/third gender, other, prefer not to say	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	3 (0)
Unknown	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0)
Client Municipality of Residence										
Brampton	3501 (82)	658 (45)	165 (19)	90 (25)	260 (74)	67 (25)	146 (66)	66 (26)	4953 (62)	12,230 (59)
Caledon	197 (5)	54 (4)	8 (1)	4 (1)	14 (4)	0 (0)	2 (1)	14 (5)	293 (4)	1368 (7)
Mississauga	538 (13)	736 (51)	710 (80)	266 (74)	72 (21)	202 (75)	73 (33)	97 (38)	2694 (33)	7140 (34)
Unknown	16 (0)	4 (0)	2 (0)	1 (0)	3 (1)	0 (0)	0 (0)	81 (31)	107 (1)	39 (0)
Initial first dose COVID-19 vaccine coverage in the area where client resided**										
Low	1073 (25)	802 (55)	741 (84)	262 (73)	97 (28)	216 (80)	94 (43)	122 (47)	1819 (23)	3978 (19)
Not low	3161 (74)	646 (44)	141 (16)	98 (27)	249 (71)	53 (20)	127 (57)	54 (21)	6117 (76)	16,741 (81)
Unknown	18 (0)	4 (0)	3 (0)	1 (0)	3 (1)	0 (0)	0 (0)	82 (32)	111 (1)	58 (0)
Distance from client residence to clinic in kilometres, median (range)***	7 (0–36)	3 (0–39)	1 (0–38)	2 (0–35)	4 (0–25)	4 (0–20)	5 (0–25)	5 (0–32)	5 (0–39)	6 (0.02-45)

* Clinic operating days were the total number of clinics in operation each day over the study period. A clinic in operation was defined as a clinic that had administered at least one dose of COVID-19 vaccine (regardless of dose number) that day

** Coverage was classified as "low" if first dose COVID-19 vaccine coverage among aged 12 years and older of the respective forward sortation area (FSA) on August 30, 2021 ranked in the lowest tertile across the 32 residential FSAs in Peel region. FSAs ranked in the middle and highest tertiles were classified as "not low"

*** Distance data not available for 144 first doses administered in community clinics and 39 first doses administered in fixed clinics due to missing residence and/or clinic postal code

Table 3 First dose coverage by FSA, August 30, 2021 and August 28, 2022, Peel region

	First Dose Coverage (12+) on Aug 30, 2021 (%)	First Dose Coverage (12+) on Aug 28, 2022 (%)	Absolute Increase (%)
Peel region	82	94	11
By forward sortation area			
Median	80	91	11
Range	71–92	83–103	1–24

Note: Forward sortation areas (FSA) are the first three digits of the postal code. Of the 36 FSAs in Peel, 32 are residential areas where coverage can be calculated. For some FSAs, vaccine uptake may exceed 100% due to assigning location of vaccine clinic to the client record for individuals without a permanent Ontario residence (e.g., international students) and/or population estimates not being accurate

distributions across municipality of residence and areas of low initial vaccine coverage when comparing community clinic locations to fixed clinics (data not shown).

Median distance between client residence to the clinics was less for community clinics (5.3 km) compared to fixed clinics (6.1 km), with clinics in shopping areas having the lowest distance (median 1 km), followed by elementary schools (median 2 km) and secondary schools (median 3 km).

Table 3 shows first dose COVID-19 vaccine coverage among Peel residents aged 12 years and older at the start of the study period (August 30, 2021) and at the end of the study period (August 28, 2022) by FSA. There was an absolute increase in vaccine coverage of 11% from the start to the end of the study period. The absolute increase varied between FSAs from 1 to 24%.

Discussion

Peel Public Health partnered with community organizations to launch community vaccination clinics to address cultural and geographic variations in vaccine uptake– which was an entirely new approach to vaccination delivery for the public health unit. Peel Public Health purposefully planned community clinics in collaboration with community-based organizations with the intention of creating opportunities for residents to receive COVID-19 vaccines in settings that were geographically accessible, familiar, and culturally appropriate. The results of this study demonstrate some success in increasing first dose uptake for those in areas of previously low vaccination coverage through community clinics.

During the study period, Peel Public Health implemented 177 community clinics in a wide variety of settings (e.g., faith-based organizations, schools, shopping areas). Community clinics were located in areas of previously low vaccination coverage and made a substantial contribution to the total number of doses (98,965) and first doses (8,047) administered. Faith-based organizations, schools (including elementary and secondary) and shopping areas were the most common community clinic locations. There were 19 community clinics in faith-based organizations, which administered 4,252 first doses and the highest average number of first doses administered per clinic operating day than other clinics.

Compared to fixed clinics, community clinics administered a slightly higher overall proportion of first doses, with community clinics located in post-secondary institutions, service organizations and faith-based organizations having greater proportions of clients receiving their first dose than fixed clinics. While community clinics had small overall differences in first dose client age, gender or geography compared to fixed clinics, heterogeneity was observed within different community clinic locations. Clients receiving first doses in community clinics located in schools (elementary and secondary) were younger and lived closer to the clinic than for fixed clinics. The majority of the first dose clients who attended clinics in shopping areas, service organizations and elementary schools also resided in low initial first dose coverage areas. Community clinic attendees overall travelled shorter distances to vaccine clinics than fixed clinic attendees, which may be an indicator of increased convenience. Differences in first dose client profiles between community clinic and fixed clinics persisted after adjusted for clinic operating days, suggesting factors beyond clinic availability may have contributed towards first dose COVID-19 vaccine uptake.

By August 2022, 94% of Peel residents (12+) were vaccinated with at least one dose of the COVID-19 vaccine. Over the one-year study period, there was an 11% absolute increase in COVID-19 vaccine uptake among those 12 + years of age. There was large variation in the absolute increase in vaccine coverage across areas of Peel (ranging from 1 to 24% absolute increase by FSA). Public health efforts to purposefully engage with community partners and service organizations through specific outreach strategies (such as deploying door-to-door community ambassadors) to understand barriers to vaccine uptake, along with establishing community clinics in familiar and trusted locations, may have contributed to the substantial increase in vaccination coverage observed.

To our knowledge, this is the first study in Canada to describe small, community-based clinics and changes in uptake of COVID-19 vaccination. These findings echo existing evidence in the literature. A recent scoping review found that vaccine awareness and uptake was increased among hesitant communities through public health agency-faith-based organization collaborations. A combination of jointly developed education and awareness campaigns, including culturally sensitive material, the use of safe and culturally acceptable spaces such as

places of worship and faith-based leaders as champions were found to be effective in promoting vaccine awareness and uptake [4].

This study has several strengths. First, the study used data from a population-level registry database that was used across the province of Ontario to capture COVID-19 vaccinations and included data on clinic name and location that facilitated further classification of community clinic type. Data were high quality as entry and completion of data elements were closely monitored by Peel Public Health and the provincial Ministry of Health. Second, the study results were based on all individuals vaccinated in both community and fixed clinics during the time period (not a sample) and therefore are representative of the whole population. Third, given the standardization of data elements collected across Ontario, the study design is relevant and applicable to other local public health units that implemented similar community clinics over the study period, in support of the "Last Mile Strategy".

This study has several limitations when interpreting the results. First, there were limited operational details available regarding each community clinic (e.g., intended population, hours of operation, number of appointments available per clinic, community outreach activities completed) which would have been useful to provide a more nuanced understanding of the characteristics of the community clinics implemented over the study period. Second, limited demographic characteristics (e.g., age, gender, residential address) were captured in COVaxON for vaccine clients, which made it difficult to fully describe how community clinic populations were different from fixed clinics. Third, information was not collected regarding reasons for selecting the clinic type and, therefore, we were unable to report on client intentions and choices for attending community versus fixed clinics. Last, we were unable to adjust for the various contextual changes that occurred over the study period that might have impacted individual choices to receive COVID-19 vaccine and which type of clinic to choose. Contextual factors may have included a rising prevalence of new COVID-19 variants (Omicron), changes in vaccine product availability and/or perceived safety, media coverage related to COVID-19 transmission and vaccination, public perception related to COVID-19 risk, COVID-19 vaccine side effects/efficacy, and introduction of other convenient vaccination options (pharmacies).

There are several implications for local vaccination delivery models based on the findings of this study. Community clinics contributed to overall COVID-19 vaccination efforts at a time in which there was geographic variability in vaccine coverage. Community engagement and partnership with community organizations played a crucial role in building and maintaining trust with residents during the COVID-19 pandemic, which contributed to the perceived success of community clinic strategies [4]. This highlights the importance of developing and maintaining strong community relationships with local organizations to ensure that public health initiatives can be effectively tailored to meet the specific needs of diverse populations. Additionally, collecting high-quality demographic and operational data is necessary to understand the potential impact and success of strategies to increase access to public health interventions by minoritized populations.

Conclusions

This study describes the results of implementation of community clinics to increase vaccination coverage in an ethnoracially diverse region of Ontario, Canada. In Peel region from September 2021 to August 2022, almost 100,000 doses of COVID-19 vaccine were administered in community clinics contributing to the observed 11% increase in first dose uptake across the region, and with community clinics reaching more residents from low coverage areas. Community-based vaccination strategies can play an important role in increasing vaccine access. Community engagements, partnerships and robust data are imperative to ensure vaccination programs are equitable.

Abbreviations

FSA Forward Sortation Area

Acknowledgements

The authors would like to acknowledge the contributions of the following Peel Public Health staff members: Jastej Dhaliwal and Hardeesh Singh for their support in extracting and de-identifying the data used in this paper; David Guillette for conducting GIS analysis to measure distances between resident address and clinic location; and Maureen Horn for providing guidance and support for all of the quantitative data analyses conducted. This research was conducted through the Structured Operational Research and Training Initiative (SORT IT), a global partnership coordinated by TDR, the Special Programme for Research and Training in Tropical Diseases at the World Health Organization. The specific SORT IT program that led to this publication included a partnership of TDR with the Dalla Lana School of Public Health and was implemented along with The Tuberculosis Research and Prevention Center, Non-Governmental Organization, Armenia; The International Union Against Tuberculosis and Lung Diseases, Paris and South East Asia offices; Médecins Sans Frontières– Luxembourg, Luxembourg. The Canadian SORT IT training accessed by team members was supported by a grant from the Canadian Institutes of Health Research (CIHR) and the Social Sciences and Humanities Research Council (SSHRC) of Canada.

Author contributions

JS is the corresponding author and made substantial contributions to the concept, design, analysis, interpretation and drafting of this paper. She has reviewed and approved the submitted version. She agrees to be personally accountable for the accuracy and integrity of the work. DNB, SR, NR and MV made substantial contributions to the concept, design, analysis, interpretation and drafting of this paper. They have reviewed and approved the submitted version. They agree to be personally accountable for the accuracy and integrity of the work. SD, AR, NP, EEN, SF and EDR made substantial contributions to the concept, design, analysis, interpretation and drafting of this paper. They have reviewed and approved the submitted version.

Funding
This work was financially supported by the CIHR (Grant #179239), 2021, and SSHRC (Grant #72065223). The funder had no role in the design, collection, analysis, and interpretation of data, nor in the writing and decision to submit this manuscript for publication.

Data availability
The data that support the findings of this study are available from Ontario Ministry of Health, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data however are available directly from the Ontario Ministry of Health, through the ***Freedom of Information and Protection of Privacy Act***, which allows access to information held by the Ministry via an online request form (https://www.ontario.ca/page/freedom-information-request). Researchers may also request access through ICES (https://www.ices.on.ca/services-for-researchers/).

Declarations

Ethics approval and consent to participate
This study adhered to the 2022 Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2), which outlines ethical treatment of human participants in Canadian research funded through three federal agencies - the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC), and the Social Sciences and Humanities Research Council of Canada (SSHRC). The TCPS2 is maintained by the Panel on Research Ethics and is aligned to the 2021 Tri-Agency Framework: Responsible Conduct of Research (2021), which outlines guidelines for maintaining research integrity throughout the research process. Research reported in this manuscript was conducted in accordance with the Declaration of Helsinki. This study received ethical approval according to TCPS2 from Public Health Ontario's Ethics Review Board (PHO ERB) on April 5, 2024. Approval for an amended submission was received on September 12, 2024. Consent for data collection was provided at the time of vaccination and was recorded within COVaxON. The need for consent to participate in this study was waived for all study participants (including those younger than 16 years of age) by PHO ERB in alignment with Article 3.7 A of TCPS2, which outlines alterations to consent for projects that pose minimal risk and only include secondary analysis of de-identified health data.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Peel Public Health, Mississauga, Ontario, Canada
[2]Centre for Global Health, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
[3]LuxOR Operational Research Unit, Operational Centre Brussels, Médecins Sans Frontières, Luxembourg City, Luxembourg
[4]Clinical Public Health Division, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
[5]Institute of Health Policy, Management, and Evaluation, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

Received: 16 December 2024 / Accepted: 5 May 2025
Published online: 27 May 2025

References

1. Gill M, Datta D, Gregory P, Austin Z. COVID-19 vaccination in high-risk communities: case study of Brampton, Ontario. Can Pharm J Rev Pharm Can. 2022;155(6):345–51.
2. Greenwood M, MacDonald N, The Royal Society of Canada. 2021 [cited 2024 Dec 5]. Vaccine Mistrust: A Legacy of Colonialism. Available from: https://rsc-src.ca/en/voices/vaccine-mistrust-legacy-colonialism
3. Newman PA, Dinh DA, Nyoni T, Allan K, Fantus S, Williams CC et al. Covid-19 Vaccine Hesitancy and Under-Vaccination among Marginalized Populations in the United States and Canada: A Scoping Review. J Racial Ethn Health Disparities [Internet]. 2023 Dec 20 [cited 2024 Dec 5]; Available from: https://link.springer.com/https://doi.org/10.1007/s40615-023-01882-1
4. Song MY, Blake-Hepburn D, Karbasi A, Fadel SA, Allin S, Ataullahjan A, et al. Public health partnerships with faith-based organizations to support vaccination uptake among minoritized communities: A scoping review. Wagner AL, editor. PLOS Glob Public Health. 2024;4(6):e0002765.
5. Forster AS, Rockliffe L, Chorley AJ, Marlow LAV, Bedford H, Smith SG, et al. Ethnicity-specific factors influencing childhood immunisation decisions among black and Asian minority ethnic groups in the UK: a systematic review of qualitative research. J Epidemiol Community Health. 2017;71(6):544–9.
6. Guay M. Sociodemographic disparities in COVID-19 vaccine uptake and vaccination intent in Canada. Stat Can [Internet]. 2022;33(82). Available from: https://www150.statcan.gc.ca/n1/pub/82-003-x/2022012/article/00004-eng.htm
7. MacDonald NE. Vaccine hesitancy: definition, scope and determinants. Vaccine. 2015;33(34):4161–4.
8. Pan American Health Organization (PAHO) [Internet]. [cited 2024 Dec 3]. Behavioral science: Vaccine demand and confidence - PAHO/WHO| Pan American Health Organization. Available from: https://www.paho.org/en/topics/immunization/immunization-toolkit/behavioral-science-vaccine-demand-and-confidence
9. Song MY, Blake-Hepburn D, Fadel S, Allin S, Ataullahjan A, Di Ruggiero E. Faith-based organisations and their role in supporting vaccine confidence and uptake: a scoping review protocol. BMJ Open. 2023;13(12):e070843.
10. Ministry of Health Public Health. Unit Boundary [Internet]. [cited 2024 Dec 6]. Available from: https://geohub.lio.gov.on.ca/datasets/c2fa5249b0c2404ea8132c051d934224_0/explore
11. Public Health Ontario [Internet]. 2020 [cited 2024 Dec 12]. Ontario Public Health System. Available from: https://www.publichealthontario.ca/en/About/News/2020/Ontario-Public-Health-System
12. Draaisma M, Seputis J. Goal of vaccinating 90% of Ontarians possible with targeted measures, public health officials say. CBC News [Internet]. 2021 Aug 26 [cited 2024 Dec 16]; Available from: https://www.cbc.ca/news/canada/toronto/public-health-officials-ninety-percent-fully-vaccinated-goal-possible-ontario-1.6153756
13. Fitzpatrick T, Allin S, Camillo C A, Habbick M, Mauer-Vakil D, Muhajarine N, et al. COVID-19 Vaccination Rollout: Ontario (Internet). 2022 (cited 2024 Jan 19). Available from: https://covarrnet.ca/wp-content/uploads/2022/02/covid-19-vaccination-rollout-ontario-2022-01-21.pdf
14. Cheung J. Mass immunization sites are starting to close but a trickier new phase of vaccine rollout is ahead. CBC News [Internet]. 2021 Jul 28 [cited 2024 Dec 16]; Available from: https://www.cbc.ca/news/canada/toronto/peel-region-mass-immunization-targeted-covid-19-1.6120187
15. Crawley M, CBC News. 2021 [cited 2024 Oct 28]. These hot spots getting vaccine priority are less hard-hit by COVID-19 than Ontario average| CBC News. Available from: https://www.cbc.ca/news/canada/toronto/ontario-covid-19-vaccination-postal-code-hot-spots-1.5983155
16. Peel Region [Internet]. 2021 [cited 2024 Oct 28]. Census Information Hub. Available from: https://census-regionofpeel.hub.arcgis.com/
17. Peel Region [Internet]. [cited 2025 Apr 10]. Peel Health Data Zone Information Tool - peelregion.ca. Available from: https://peelregion.ca/health/health-status-data/peel-health-data-zone-information-tool

Publisher's note