



# COVID-19 Care Clinic in a Medical Center: Lessons Learned

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## Abstract

**Objective:** The purpose of this report is to describe the elements of a Covid-19 Care Clinic (CCC), patient demographics, and outcomes. **Methods:** Descriptive statistics were used to describe demographics, clinical characteristics, and outcomes. This report is based on 4934 unique patients seen in the CCC who provided research authorization within a 10-month period of time (April 1, 2020-January 31, 2021). The CCC infection control processes consisted of a rooming process that mitigated SARS-CoV-2 transmission, preparing examination rooms, using PPE by staff, in room lab drawing, and escorting services to minimize the time in clinic. **Results:** Of the 4934 unique patients seen (age range newborn-102 years), 76.8% were tested for COVID-19. Of those tested, 11.8% were positive for SARS-CoV-2. Ninety-two percent of the patients with the reason for the visit documented had COVID-19 type symptoms. Cough, shortness of breath, and chest pain were the most common presenting symptom in those with COVID-19. At the time of the visit in the CCC, 5.8% of the patients were actively contagious. Thirty days after being seen in the CCC, 9.1% of the patients were seen in the emergency department (ED) and 0.2% died. During the 10-month period there were no known occupationally related COVID-19 infections. **Conclusion:** The COVID-19 Care Clinic provided face-to-face access for all ages with COVID-19 type symptoms. A minority of patients had COVID-19 who were seen in the clinic. The clinic provided an additional venue of care outside of the ED. The infectious control measures employed were highly effective in protecting the staff. Lessons learned allow for decentralization of COVID-19 symptom care to the primary care practices employing the infection control measures.

## Keywords

Covid Care Clinic, COVID-19, pediatric, adult, infection control

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## Introduction

In March 2020, the SARS-CoV-2, which causes COVID-19 infection, was declared a pandemic. During this time while COVID-19 infections were beginning to rise, there was limited knowledge regarding the manifestations and care of patients with COVID-19 in the ambulatory setting. There were several concerns in the care of these patients including: protection of patients and staff from contracting SARS-CoV-2 and the uncertainty regarding the supply of personal protective equipment. Lastly, the risk of high emergency department (ED) patient volumes if there were no primary care options for COVID-19 patients was a concern. To mitigate these issues, our health care facility developed a system to accommodate the care for ambulatory patients with potential COVID-19, confirmed COVID-19, and patients

on quarantine after being exposed to COVID-19. The system consisted of Nursing (RN) Triage, COVID Frontline Care Team (CFCT) for the care of low risk and intermediate risk COVID-19 infected adults, Remote Patient Monitoring (RPM) for the care of high risk COVID-19 infected adults, Pediatric COVID Care Team for high risk COVID-19 infected pediatric patients, centralized COVID-19 Testing Center, Telemedicine, and COVID-19 Care Clinic (CCC).<sup>1,2</sup>

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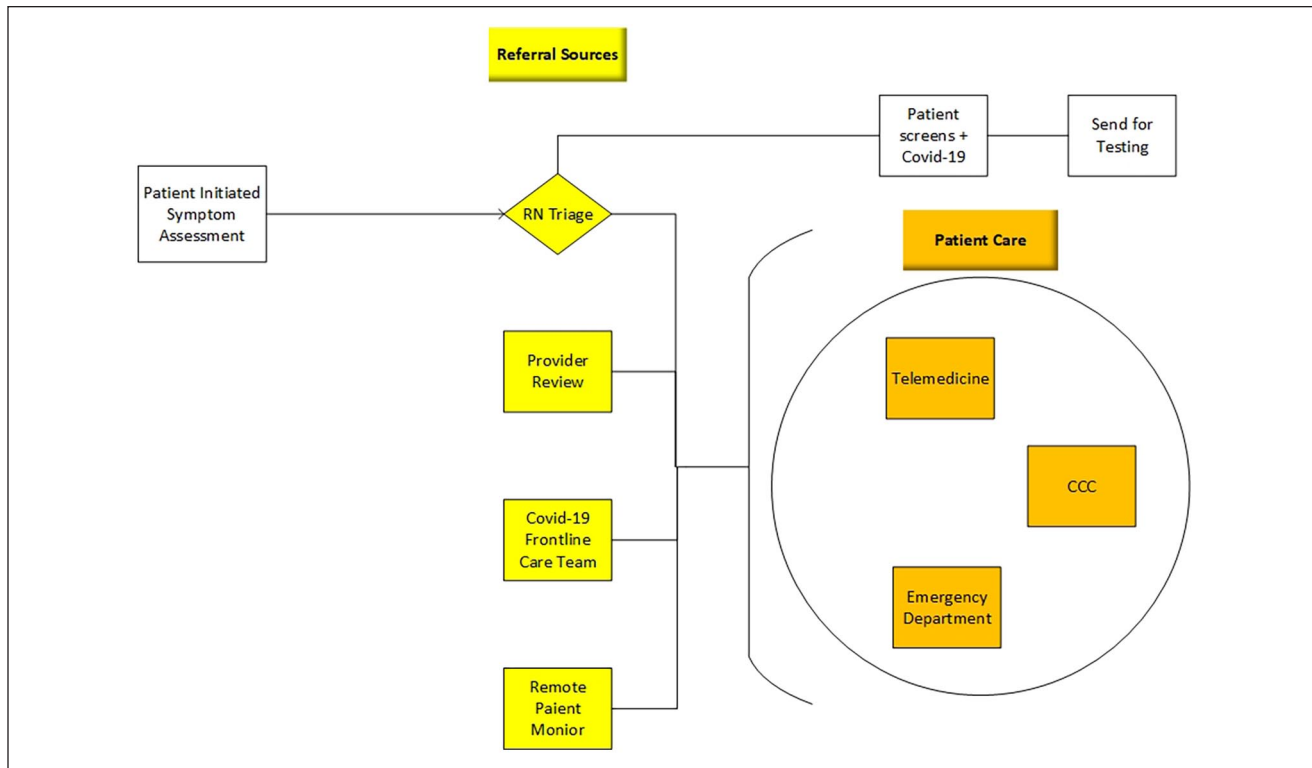
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**Figure 1.** Schematic depiction of the patient flow.

This network of offerings worked in concert to provide expert and timely care, with a goal of minimizing exposure to SARS-CoV-2 to uninfected patients and healthcare personnel. The aim of this study is to describe the elements of the CCC, patient demographics, symptoms reported, and outcomes. Patients gained access to the CCC clinic through RN Triage, RPM, CFCT, primary care provider directed, or after a telemedicine visit (Figure 1). In addition, this report presents lessons learned from the centralized CCC and a framework for primary care to decentralize the in-person care of COVID-19 patients and/or patients with COVID-19 type symptoms.

## Methods

This retrospective study was reviewed by The our Institutional Review Board (IRB) and determined to be exempt under section 45 CFR 46.101, item 2. During the study, all significant changes to study design and procedures were appropriately filed, reviewed, and approved by the IRB.

## Patient Population and Setting

The CCC was housed in Rochester, Minnesota in one of the neighborhood primary care clinics. The CCC was established for ambulatory patients with potential COVID-19, confirmed

COVID-19, patients on quarantine after being exposed to COVID-19 (Table 1). Initially the entire primary care operations of the clinic were transitioned to other primary care clinics in the city. Later, starting June 2020, only an isolated portion of the facility was used for the CCC, leaving other parts of the facility open for non-COVID-19 patients. The CCC was contained by mounting temporary walls and doors, separate nurse's station, provider offices, patient entry into the CCC, and continued use of infectious control processes. The electronic medical records of 5451 unique patients who were seen in the CCC for a 10-month period dating from April 1, 2020 to January 31, 2021, were reviewed. Per Minnesota, USA statute, patients were excluded if they refused research authorization (N=517). This report is based on the 4934 unique patients seen in the CCC who provided research authorization.

## Description of the COVID Clinic and Process

### Staffing Structure

In establishing the CCC, the leadership and staffing structure of a standard Primary Care Clinic was followed. The site was led by an onsite medical director, charge nurse, and operations manager who oversaw the daily operations. Given the potential exposure to

**Table 1.** COVID Care Clinic Patients.

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COVID-19 positive individuals (still in isolation status)  
 Individuals under quarantine for COVID-19 positive contact  
 Potential COVID-19 (test results pending)  
 COVID-19 Negative >48h with continued symptoms (see list below)

Patients with symptoms that may be due to COVID-19 infection:

- Fever
- Cough
- Shortness of breath
- Sore throat
- Diarrhea
- Nausea
- Vomiting
- Respiratory distress
- Chills
- Muscle ache
- Repeated shaking with chills
- Headache
- Loss of smell
- Change or loss of taste sensation
- Skin changes or rash
- Inflammation of testis

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SARS-CoV-2, volunteer staffing for the CCC was pursued and there was no difficulty reaching goal level staffing with volunteers.

The CCC leadership consisted of 2 co-medical directors, 2 charge nurses, and an operations manager. Having 2 medical directors and charge nurses allowed staff to rotate to other (non-COVID) responsibilities. Table 2 lists specific staff roles.

## Referral of Patients to the CCC

By design there was no self-referral or “walk in” process for the CCC patients. Patients first had to first go through an evaluation process before scheduling for the CCC. The criteria for referral to the CCC were the same criteria which would have resulted in a direct ED referral. Thus, each CCC patient meant one less ED referral. Since at the time, none of the primary care practices were scheduling face-to face appointments for patients with COVID-19 type symptoms. The pre-CCC evaluation consisted of RN Triage, video visit, or telephone visit with the patient to assess the patient’s symptoms, and determine if care could be provided outside of an onsite visit. Initially, two-thirds of the patients were accommodated by the video visit, eliminating the need for a face-to-face visit in the CCC.<sup>3</sup> Through time, patients were increasingly directly referred to CCC without a video visit. For patients with limited English proficiency, and limited computer proficiency, who called with symptoms, a face-to face visit was scheduled in the CCC for those who needed further evaluation by a provider, instead of a video visit.

## Clinic Preparation to Mitigate Virus Exposure

All equipment that would typically be left outside an exam room, in a nurse’s room or in a hallway, such as an Automated External Defibrillator or mobile baby scale, was placed inside closets or other non-patient rooms to minimize the potential for pathogen exposure. Additionally, only lesser amounts of necessary supplies, such as tongue depressors, swabs, disinfectant wipes, hand sanitizer, etc. were kept in the exam rooms to prevent potential contamination. All non-essential equipment and items (cloth pillowcases, paper exam table covering) were removed from the exam rooms to facilitate room cleaning after each patient.

## Protection of CCC Staff

Strict infection control processes were implemented. Universal precautions for infection control were implemented since every patient seen had COVID-19 type symptoms. All care team staff were dressed in full personal protective equipment (PPE), including surgical mask, face shield, gloves, and gowns, when interviewing/examining/drawing blood/imaging the patient. The gowns, masks, and gloves were disposed of after each patient encounter. The face shield/goggles were disinfected.

Outside of patient exam rooms, face masks were worn by all employees while on site. Staff worked at physically distanced desks and ate at physically distanced tables (greater than 6’ apart).

A screener at the front door and the desk operations staff wore masks with an attached face shield. To preserve PPE, screeners and desk operations staff kept the same mask with face shield on during their shift unless there was soiling of the mask/shield by a patient encounter.

## Patient Flow

### Patient Arrival and Reception

A rooming process was implemented for most patients which eliminated patients sitting in the clinic’s lobby. Upon arrival at the clinic’s parking lot the patient was instructed to call the front desk for a virtual check-in. When ready to room the patient, nursing staff called the patient while the patient was still in his/her vehicle and asked the patient to come to the building entrance. The nurse, wearing full personal protective equipment, received the patient at the front door and immediately escorted the patient to the examination room.

For patients without a mobile phone, a door screener would confirm that the patient had a scheduled appointment at the CCC. The patient was then provided with a mask and

**Table 2.** COVID Care Clinic Staffing.

Role	Responsibility
Medical Director	Recruitment of provider staff (physicians, nurse practitioners, physician assistants), develop staffing plans based on patient volumes, education, develop processes, develop plan to re-integrate care into primary care as COVID-19 infections decline
Charge Nurse	Coordination of unit activities, collaborated on development of processes, delegation of tasks, and supervision of nursing staff
Operations Manager	Escalate decision making and issue resolution, operational process adjustment and modification, and communicate with department/division or COVID leadership
LPN/RN	Obtained patients vitals, reason for visit, medication reconciliation (LPN). Provided education to patients and nurse visits for strep throat cultures (RN).
Medical Administrative Assistant	Support for provider correspondence and prescriptions.
Desk Operations	Complete patient check-in/check-out as well as scheduling follow-up appointments
Pharmacy	Provide onsite prescriptions to COVID-19 infected patients.
Radiology	Provide plain X-ray support of COVID-19 infected patients.
Lab	Provide venipuncture support of COVID-19 infected patients.
Specimen Transport	Transport specimens to centralize processing location every 45 min.

directed to the front desk of the CCC. The desk operations specialist checked the patient in and asked him/her to take a seat in the lobby, in the appropriate zone. Zone 1 was for pediatric patients; Zone 2 was for patients aged 19 to 59; Zone 3 was for patients aged 60 and older. One visitor was allowed per patient. Once the care team was ready to see the patient, the nurse met the patient at the lobby entrance and brought the patient to the exam room.

## Testing

The following tests were available onsite: Electrocardiogram, portable anterior-posterior chest X-ray, blood, and urine tests. Early in the COVID-19 pandemic an onsite radiologist was available to provide diagnostic ultrasound for assessing COVID pneumonia and other acute ill indications. Testing for COVID-19 was not done within the CCC to reduce contact with potential COVID-19 positive patients in the CCC. A separate testing facility was used for this purpose.

Every attempt was made to limit the exposure of the patient outside of the examination room. Venipuncture was performed in the exam room. There was a procedure room that was transformed into the EKG and portable chest X-ray room. The patient would be escorted to the room by the radiology technician. The laboratory and radiology technicians were notified to come to the room through real-time electronic medical record chat messaging.

## Nebulized Treatments

Several patients seen in the COVID-19 Clinic required bronchodilator treatment for underlying diagnoses of asthma or emphysema. Pre COVID-19 nebulizing practices would have required the room to be unoccupied for 2 h after

nebulizing and the nurse would need to wear an N95 respirator.

The use of breath actuated nebulizers (BAN) with a Hudson filter allowed us to nebulize patients in the clinic instead of using the albuterol meter-dose-inhaler (MDI) for appropriate patient populations. With BAN a 2-h room closure was unnecessary and the nurse administering the BAN did not need to wear a respirator (just the usual PPE for the COVID-19 clinic).

The BAN could only be used on those greater than 30 kg and who can effectively use the BAN and maintain a mouth seal. For patients less than 30 kg or who cannot effectively use the BAN, the albuterol MDI with spacer was still an option.

## Data Collection

Study data was retrieved from the electronic medical record for all patients who had an appointment in our facility, CCC during the 10-month study period. This resulted in a total of 4934 unique patient visits. The data abstracted included demographics (date of index visit, date of birth [from which we calculated age at time of CCC contact], sex, race, ethnicity, date of death [if applicable]), hospitalization related information (date of visit, admission/discharge dates, reason for ED visit, and diagnosis description).

## Statistical Analysis

Descriptive statistics were used to describe demographics, clinical characteristics, and outcomes. Categorical variables were reported as percentages and chi-square tests and continuous variables with Kruskal-Wallis tests. ED visits and hospitalizations were reported 30 days after being seen in the CCC. The first symptom in the list for each patient was

grouped by prevalence, and the top 3 symptoms by positive COVID-19 test result time period were reported. The top 5 most prevalent symptoms were then searched for in each patient's entire symptom list. Patients with any symptoms in the list that were related to COVID-19 were flagged. The prevalence of the top 5 symptoms was broken down by age category, COVID-19 test results within a 10 day prior to 1 day after CCC visit, and the interaction between age and result.

## Results

There were 7095 visits by 5451 unique patients in the CCC between April 1, 2020, and January 31, 2021. Of the 5451 unique patients 4934 patients provided research authorization. CCC patients were newborn to 102 years old (Table 3). The median age seen in the CCC was 35 years. The majority of patients were between 18 and 65 years of age. For patients less than 18 years of age, the median age was 3 years of age (range 0.0, 17.0). The median age for those over age 65 was 75 years of age (range 66.0, 102.0).

The majority of patients seen were female (60.7%) and white (83.3%). However, when broken down by age categories the <18 years old had equal numbers of males and females. The greatest race diversity was present in the less than 18-year-olds with 2.7% Asian, 7.9% black, 9.2% other, 2.5% unknown, and 77.8% white. In the over age 65-year-olds, there were 94.4% white (Table 3).

Of the 4934 unique patients seen, 76.8% were tested for SARS-CoV-2. The decision to test for SARS-CoV-2 was based on the CDC's recommendations during the 10 months of the study which was built into the RN Triage algorithm and clinician's determination of the patient's comorbidities and presenting symptoms when seen face-to-face. Of those tested 11.8% were positive for SARS-CoV-2. Patients were tested for SARS-CoV-2 from 45 days before to 267 days after their visit to the CCC. The median time of being tested for SARS-CoV-2 was on the day of the visit for those over age 65 years and less than 18 years, and the day before the visit for those 18 to 65 years of age.

There were 450 admissions (9.1%) to the Emergency Department (ED) from the 4934 patients seen in the CCC (Table 4). The median number of days to be seen in the ED after the CCC visit was 2.5 days overall with a range of 0 to 30 days. The median age seen in the ED was 44 years (range newborn-93 years). Rates of ED visits were similar across gender and race. Of the 450 patients seen in the ED, 13.6% had COVID-19, 66.7% had a negative SARS-CoV-2 test, and 19.8% were not tested for SARS-CoV-2.

Eight patients seen in the CCC died within 30 days after their visit. Five of the deaths occurred in patients transferred to the ED.

Actively contagious COVID patients, defined as being SARS-CoV-2 PCR (Polymerase Chain Reaction) positive

10 days before the visit or 1 day after the visit, constituted 5.8% of the unique patient visits. Most actively contagious patients seen in the CCC were aged 18 to 65 years.

The reason for the office visit was listed for 77% (3797 patients) of the patients seen in the CCC. Of the 3797 patients, 92%, had symptoms that could represent a COVID-19 infection. When considering up to 5 symptoms listed as the reason for the visit, cough (25.7%) was the most common symptom followed by fever (19.2%), sore throat (17.6%), shortness of breath (16.3%), and abdominal pain (6.6%) (Table 5). In those tested for SARS-CoV-2, positive results were more common in those who presented with cough and shortness of breath. Interestingly, chest pain was the third most common presenting symptom in SARS-CoV-2 positive patients. Sore throat was a less common manifestation of COVID-19. Further analysis by age groups and SARS-CoV-2 positivity provided too few numbers of patients for the <18 and >65 year of age group to come to any conclusions. Eighty percent of the patients presenting with sore throat were seen by an RN and swabbed for Group A Strep by protocol. In patients less than 18 years of age, fever was the most common presenting symptoms, in those greater than 19 years of age, cough was the most common presenting symptom.

Since acute COVID-19 has a biphasic pattern of viral replication followed by an inflammatory/immunity phase the first symptom reported for the reason for the visit for weeks 1 to 4 was evaluated (Table 6). The most prevalent symptoms for each of the 4 weeks were cough and shortness of breath. Fever was seen in weeks 1 and 3, fatigue in the second week, and headache in the fourth week as the third listed symptom.

From April 1, 2020 through January 31, 2021, there were no occupationally contracted cases of SARS-CoV-2 by the staff working in the CCC.

## Discussion

To our knowledge this report has one of the largest number of patients and the first COVID-19 Clinic for both pediatrics and adults in the literature. The COVID-19 ambulatory care processes model provided care for patients with potential COVID-19, confirmed COVID-19, and on quarantine with Monday to Saturday appointment availability. The CCC provided experience and confidence with the infectious control measures for patients and staff and developed knowledge and expertise in the care of patients with COVID-19. Here the CCC is described, which provided the face-to-face patient assessment option of the COVID-19 ambulatory care process model. Patients were seen in the CCC after initial assessment by their provider via the patient portal, telephone triage, and/or video visit. Per protocol, patients were seen in the CCC if they had any symptoms that could be related to COVID-19 or were on quarantine.



**Table 3.** Descriptive Characteristics.

	Age categories			Total (N=4934)	P-value
	<18 (N=1419)	18-65 (N=2744)	>65 (N=771)		
Age (years)					<.0001 <sup>a</sup>
N	1419	2744	771	4934	
Mean (SD)	5.5 (5.46)	40.8 (13.71)	75.9 (7.46)	36.1 (25.52)	
Median	3.0	40.0	75.0	35.0	
Range	0.0, 17.0	18.0, 65.0	66.0, 102.0	0.0, 102.0	
Gender, n (%)					<.0001 <sup>b</sup>
Female	707 (49.8%)	1863 (67.9%)	426 (55.3%)	2996 (60.7%)	
Male	712 (50.2%)	880 (32.1%)	345 (44.7%)	1937 (39.3%)	
Unknown	0 (0.0%)	1 (0.0%)	0 (0.0%)	1 (0.0%)	
Race, n (%)					<.0001 <sup>b</sup>
Asian	38 (2.7%)	97 (3.5%)	15 (1.9%)	150 (3.0%)	
Black	112 (7.9%)	186 (6.8%)	12 (1.6%)	310 (6.3%)	
Other	130 (9.2%)	154 (5.6%)	12 (1.6%)	296 (6.0%)	
Unknown	35 (2.5%)	30 (1.1%)	4 (0.5%)	69 (1.4%)	
White	1104 (77.8%)	2277 (83.0%)	728 (94.4%)	4109 (83.3%)	
Covid test results (overall), n (%)					<.0001 <sup>b</sup>
Detected	45 (4.4%)	336 (15.3%)	67 (11.6%)	448 (11.8%)	
Undetected	968 (95.6%)	1863 (84.7%)	510 (88.4%)	3341 (88.2%)	
Not tested	406	545	194	1145	
Covid test time (in days) from test to clinic visit.					<.0001 <sup>a</sup>
N	1013	2199	577	3789	
Mean (SD)	0.7 (18.62)	-2.0 (13.73)	-1.0 (9.97)	-1.1 (14.78)	
Median	0.0	-1.0	0.0	-1.0	
Range	-45.0, 242.0	-45.0, 267.0	-35.0, 103.0	-45.0, 267.0	
Covid test results (10 days before or 1 day after CCC visit), n (%)					<.0001 <sup>b</sup>
Detected	35 (4.0%)	205 (11.4%)	49 (10.3%)	289 (9.2%)	
Undetected	840 (96.0%)	1587 (88.6%)	429 (89.7%)	2856 (90.8%)	
Not tested	544	952	293	1789	
Admission to Emergency Department (ED) within 30 days of clinic visit, n (%)					<.0001 <sup>b</sup>
No	1336 (94.2%)	2500 (91.1%)	648 (84.0%)	4484 (90.9%)	
Yes	83 (5.8%)	244 (8.9%)	123 (16.0%)	450 (9.1%)	
ED time from clinic visit to ED admission (in days)					0.1285 <sup>a</sup>
N	83	244	123	450	
Mean (SD)	7.3 (8.83)	6.4 (8.18)	5.3 (7.51)	6.3 (8.14)	
Median	3.0	3.0	2.0	2.5	
Range	0.0, 30.0	0.0, 30.0	0.0, 29.0	0.0, 30.0	
Death within 30 days of clinic (CCC) visit, n (%)					<.0001 <sup>b</sup>
No	1419 (100.0%)	2742 (99.9%)	765 (99.2%)	4926 (99.8%)	
Yes	0 (0.0%)	2 (0.1%)	6 (0.8%)	8 (0.2%)	
Possible COVID symptoms at time of CCC visit, n (%)					<.0001 <sup>b</sup>
No	54 (4.9%)	183 (8.7%)	66 (11.1%)	303 (8.0%)	
Yes	1037 (95.1%)	1926 (91.3%)	531 (88.9%)	3494 (92.0%)	
No symptoms listed	328	635	174	1137	

<sup>a</sup>Kruskal-Wallis P-value.<sup>b</sup>Chi-Square P-value.

**Table 4.** Demographics by Emergency Department Admission.

	Admit to emergency department		Total (N=4934)	P-value
	No (N=4484)	Yes (N=450)		
Age (years)				<.0001 <sup>a</sup>
Mean (SD)	35.3 (25.31)	44.6 (26.15)	36.1 (25.52)	
Median	34.0	44.0	35.0	
Range	0.0, 102.0	0.0, 93.0	0.0, 102.0	
Gender, n (%)				.9506 <sup>b</sup>
Female	2723 (90.9%)	273 (9.1%)	2996 (60.7%)	
Male	1760 (90.9%)	177 (9.1%)	1937 (39.3%)	
Unknown	1 (100.0%)	0 (0.0%)	1 (0.0%)	
Race, n (%)				.4121 <sup>b</sup>
Asian	137 (91.3%)	13 (8.7%)	150 (3.0%)	
Black	285 (91.9%)	25 (8.1%)	310 (6.3%)	
Other	267 (90.2%)	29 (9.8%)	296 (6.0%)	
Unknown	67 (97.1%)	2 (2.9%)	69 (1.4%)	
White	3728 (90.7%)	381 (9.3%)	4109 (83.3%)	
Covid test results (10 days before or 1 day after CCC visit timeframe), n (%)				<.0001 <sup>b</sup>
Detected	228 (78.9%)	61 (21.1%)	289 (5.9%)	
Undetected	2556 (89.5%)	300 (10.5%)	2856 (57.9%)	
Not tested	1700 (95.0%)	89 (5.0%)	1789 (36.3%)	
Death within 30 days of clinic visit, n (%)				<.0001 <sup>b</sup>
No	4481 (91.0%)	445 (9.0%)	4926 (99.8%)	
Yes	3 (37.5%)	5 (62.5%)	8 (0.2%)	

<sup>a</sup>Kruskal-Wallis P-value.<sup>b</sup>Chi-Square P-value.**Table 5.** Top 5 Symptoms.

	Cough (%)	Sore throat (%)	Fever (%)	Shortness of breath (%)	Abdominal pain (%)
Overall	977 (25.7)	668 (17.6)	731 (19.2)	618 (16.3)	250 (6.6)
Age*	†	†	†	†	†
<18	240 (21.9)	190 (17.4)	430 (39.3)	49 (4.5)	67 (6.1)
18-65	550 (26.1)	433 (20.5)	250 (11.8)	400 (18.9)	159 (7.5)
>65	187 (31.3)	45 (7.5)	51 (8.5)	169 (28.3)	24 (4.0)
Covid results**	†	†	†	†	†
Detected	80 (33.1)	16 (6.6)	45 (18.6)	71 (29.3)	11 (4.5)
Undetected	617 (25.4)	510 (21.0)	529 (21.7)	375 (15.4)	177 (7.3)
Age by result					
Detected, <18	4 (14.3)	4 (14.3)	8 (28.6)	2 (7.1)	2 (7.1)
Undetected, <18	160 (22.6)	148 (20.9)	311 (44.0)	31 (4.4)	46 (6.5)
Detected, 18-65	60 (35.3)	10 (5.9)	31 (18.2)	56 (32.9)	8 (4.7)
Undetected, 18-65	341 (25.1)	336 (24.8)	179 (13.2)	239 (17.6)	115 (8.5)
Detected, >65	16 (36.4)	2 (4.5)	6 (13.6)	13 (29.5)	1 (2.3)
Undetected, >65	116 (31.4)	26 (7.0)	39 (10.6)	105 (28.5)	16 (4.3)

\*Missing data: Overall=1131, Age (&lt;18)=325, Age (18-65)=633, Age (&gt;65)=173.

\*\*Covid results missing data: there were 1789 people with no Covid test results, undetected=423, detected=47. Covid test results are from tests done 10 days prior or 1 day after the clinic visit.

†P-value &lt;.05.

**Table 6.** Symptoms by Positive Test.

Positive test	N*	Symptom 1	Symptom 2	Symptom 3
<7 Days before to 7 days after	174	Cough (21.3%)	Shortness of breath (16.1%)	Fever (6.9%)
7-13 Days before	107	Cough (24.3%)	Shortness of breath (15.9%)	Fatigue (8.4%)
14-20 Days before	50	Cough (32.0%)	Shortness of breath (12.0%)	Fever (10.0%)
21-28 Days before	17	Cough (41.2%)	Shortness of breath (17.6%)	Headache (11.8%)

\*Missing data: <7-7 days = 33, 7-13 days = 25, 14-20 days = 11, 21-28 days = 1.

This study reviewed 10 months of the CCC experience. During this period there were 4934 unique patients seen. COVID-19 testing was done on 76.8% of the CCC patients with 11.8% testing positive for COVID-19. Interestingly, only 5.8% of the patients were actively contagious at the time of their visit. Compared to the Cough Cold and Fever (CCF) Clinic at New York Presbyterian-Weill Cornell Medicine, which was implemented March 2020 to evaluate, triage, and treat adult outpatient with symptoms of COVID our testing rate was higher and positivity rate lower. This difference was due to scarce PCR testing resources available early in the pandemic for the CCF.<sup>4</sup> Another COVID-19 Clinic in Washington DC, saw 2821 patients after triage from March until June 2020 with 87.9% SARS-CoV-2 tested with 34.2% positive, which was a higher testing and positivity rate than this current report. The Washington DC Clinic patients were similar gender distribution to the CCC in this current report; however, the mean age was 7 years older since the Washington DC Clinic provided care only for adults, and the Black/African patients constituted 49.7% compared to 6.3% in the CCC.<sup>5</sup> In addition, the Washington DC data was reported for a 3-month period during a period of high SARS-Cov-2 prevalence versus our 10-month reporting period during which there was variable SARS-CoV-2 prevalence. During the published study periods, New York, Washington DC, and Minnesota experienced peak COVID-19 numbers in April 2020 (3386, 7 day average cases/day), May 2020 (194, 7 day average cases/day), and November 2020 (195, 7 day average cases/day) respectively.<sup>6</sup>

Early in the pandemic there was concern for high demand in the emergency department. The CCC was formed to provide a venue for the care of patients with COVID-19 other than the ED. Over a 10-month period, 9.1% (450 patients) of the patients were also seen in the ED. Of the 450, only 13.6%, of those seen in the ED from the CCC were positive for COVID-19. The CCF Clinic had similar ED rates of 8% over a 3-month study period.<sup>4</sup>

The death rate was 0.2% of patients presenting to the CCC. This rate compares to 2% deaths CCF Clinic and 0.4% death rate at the COVID-19 Clinic in Washington DC.<sup>4,5</sup> The low death rate may be due to the highly triaged patient population seen with sicker patients being advised to be seen in the ED, predominately white population and/or differences in co-morbidities.

Another goal of the CCC was to reduce the risk of SARS-CoV-2 transmission to medical personnel. The implementation of PPE, physically distanced workstations, and universal masking while in clinic resulted in no known occupational acquired COVID infections. This contrasts with the CCF Clinic study which reported several COVID-19 infections due to delayed implementation of universal mask wearing in all areas of the clinic, as a result of limited PPE.

The non-specific nature of COVID-19 symptoms resulted in a high percentage of patients being seen in the CCC who did not have COVID-19. The CCC was available to patients who were in quarantine for COVID exposure, however, this was a minority of patients. The centralized face-to-face care model resulted in a lack of continuity of care for patients. This was most challenging for patients with multiple chronic comorbidities. For example, shortness of breath due to an exacerbation of known chronic conditions such as asthma, COPD, and heart failure by symptom-based RN telephone triage resulted in an appointment in the CCC. These patients may have been better served by their primary care provider.

The most common symptoms leading to an appointment in the CCC for SARS-CoV-2 positive patients were cough, shortness of breath, and chest pain. There were differences in the most common symptom for COVID-19 positive patients by age with those less than 18 presenting more commonly with fever and over 18 with cough. Sore throat was a less common manifestation in those positive for COVID. Utilization of a nurse only visit for strep/COVID swabbing, for this common symptom, allowed for more appointment access for other patients requiring provider assessment. The results of the CCC in this current report was similar to the adult COVID-19 Clinic in Washington DC, in that sore throat was an infrequent presenting symptom of COVID-19.<sup>5</sup>

In this report no change in symptoms based on the duration of time since the positive PCR was observed. Initial symptoms, such as fever, myalgia, headache is the result of viral replication which is followed by an inflammatory response.<sup>7</sup> For the majority of those with COVID-19 this leads to recovery. An aggressive immune response can lead to severe disease resulting in high fever and/or hypoxia. This was due to severely ill patients being triaged to the ED



**Table 7.** Covid-19 Care Clinic Flow Justification.

COVID-19 Care Clinic	Purpose	Requirements	Priority to continue
Physically isolated clinic setting	Decreases patient and staff SARS-CoV-2 exposure	Translocation of personnel	Low*
Triage	Advice on timeframe to be seen and venue (video visit, ED, CCC, primary care)	Dedicated RNs, Triage algorithms	High
Video visit	Non-face-to-face option for patient convenience and reduced exposure	Video connectivity for providers and patients	Medium
Virtual check-in	Decreases patient and staff SARS-CoV-2 exposure	Patient mobile device to communicate on arrival to be checked in	Medium
Rooming direct from vehicle	Decreases patient and staff SARS-CoV-2 exposure	Patient mobile device to communicate on arrival to be checked in	High
Zones in waiting room	Decreases patient and staff SARS-CoV-2 exposure	Physically reconfigure waiting room seating to accommodate patients without mobile devices	High
Limited radiology	Decreases patient and staff SARS-CoV-2 exposure	Dedicated X-ray equipment	Low**
Laboratory drawn in exam room	Decreases patient and staff SARS-CoV-2 exposure	Adequate lab personnel to travel to rooms to draw bloods	High
Special room cleaning and preparation	Decreases patient and staff SARS-CoV-2 exposure	Staff and chemicals for cleaning after each use	High
Patient escorted in/out of clinic	Decreases patient and staff SARS-CoV-2 exposure	Available allied health staff	High
PPE for staff in room	Decreases staff SARS-CoV-2 exposure	Adequate PPE supply for each visit	High
Staff work stations physically distanced	Decreases staff SARS-CoV-2 exposure	Adequate number of workstations with physically distanced configuration	High
Staff break tables physically distanced	Decreases staff SARS-CoV-2 exposure	Adequate break room size with physically distanced configuration	High

\*Decentralize back to primary care.

\*\*Employ special room cleaning.

and variable SARS-CoV-2 testing durations after patients were symptomatic. Therefore, the days after the PCR do not correlate with the phase of the illness.

There are many strengths of this current study. First, this study describes a real-world implementation of COVID-19 care process model in the ambulatory setting. Second, to our knowledge, this is the first report of a COVID-19 Clinic care of pediatric patients which allowed for age stratification of demographics and presenting symptoms.

In addition to the strengths there are also weaknesses to this study. The weaknesses are inherent to the fact that this is an analysis of retrospective clinical data. The focus of this report and the database used was data which was collected for clinical care and therefore not specific to a research question. First, patient evaluation was based on the reason for the visit and not on the visit diagnosis. This was due to nonspecific diagnostic codes being used. Second, the reason for the visit was missing 23% of the time. Third, the reported experience is based on the dominant variant at the time, which was the *alpha* and *beta*. The *delta* SARS-CoV-2 variant, which was not prevalent during the time of the data

collection, is known to be more contagious and may have resulted in CCC staff acquiring COVID-19 from patients. Fourth, assumptions were made on infectivity based on days after the COVID-19 PCR test and not on the first day of symptoms, which may overestimate the number of contagious patients. Fifth, some patients may have been seen in outside of our facility ED, which would not have been included in the study data.

Since a minority of patients seen in the COVID-19 Clinic were actively contagious for SARS-CoV-2 virus and there were no occupationally related COVID-19 infections among the CCC staff, the care of patients with COVID-19 symptoms was transferred back to their primary provider in May 2021, utilizing infectious control measures such as telehealth visits where appropriate. The following lessons were learned from implementation and experience with the CCC: (1) virtual check in (Patients calling from his/her car); (2) rapid rooming; (3) specifically prepared examination rooms; (4) consistent use of PPE by staff; (5) in room venipuncture; and (6) escort services to minimize patient time in the clinic (Table 7).

## Conclusion

The CCC provided a venue other than the ED for COVID-19 patients to be evaluated and helped patients and staff feel safe and gain confidence in the care of the COVID-19 patient. It allowed for the development and implementation of infectious control processes at 1 site that allowed for dissemination to primary care. The transition to providing care to patients with COVID-19 type symptoms to the primary care provider with these learning was preferable for continuity of care. Most patients seen with COVID-19 type symptoms early in the pandemic did not have COVID-19. The CCC model for the COVID-19 pandemic was entered into with trepidation in April 2020 but was found to be valuable in protecting the patients and staff.

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## Authors' Contributions

All the authors participated in the study concept and design, analysis, and interpretation of data, drafting and revising the paper, and have seen and approved the final version of the manuscript.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Ethical Standards

All authors assert that all procedures contributing to this work comply with the ethical standards of the Mayo Clinic.

## Ethics and Consent to Participate

In accordance with the Declaration of Helsinki, this study was reviewed and found to be exempt (ID 21-002038) by the Mayo Clinic Institutional Review Board (IRB). Mayo Clinic IRB approved informed consent waiver.

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## Availability of Data and Materials

All data supporting the study findings are contained within this manuscript.

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