Clinical Epidemiology of a SARS-CoV-2 Outbreak at a Large Refugee Shelter in Toronto, April 2020

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Abstract

Background:

There is high risk of spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in congregate settings, including shelters. This study describes a coronavirus disease 2019 (COVID-19) outbreak and corresponding reported symptomatology at one of the largest refugee shelters in Toronto.

Methods:

All adult residents on-site at the shelter (n=63) were offered SARS-CoV-2 testing on April 20, 2020. At the time of testing, residents were screened for three typical COVID-19 symptoms (fever, cough, and shortness of breath). Among those who tested positive, a more comprehensive clinical assessment was conducted 1 day after testing and a standardized 15-item symptom screen was administered by phone 14 days after testing. We report rates of positive test results and clinical symptoms with each assessment interval.

Results:

Among the 60 adults who underwent testing, 25 (41.6%) were positive for SARS-CoV-2 infection. At the time of testing, 20% of those who tested positive reported fever, cough, or shortness of breath. On more detailed assessment 1 day later, 70.8% reported a broader range of symptoms. During the 14 days following testing, 87.5% reported symptoms of infection.

Interpretation:

Our study underscores the high risk of SARS-CoV-2 transmission in congregate living settings and the importance of mobilizing timely testing and management of symptomatic and asymptomatic residents in shelters. We also found that while most individuals with infection initially appeared asymptomatic on a basic symptom screen, the majority were presymptomatic and ultimately developed symptoms of COVID-19, pointing to the value of evaluating for diverse symptoms suggestive of infection.

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection can spread rapidly within congregate living settings.(1–4) Homeless shelters, like long-term care facilities and other congregate settings, are densely populated environments, posing difficulties for physical distancing and intensifying risks for infectious disease outbreaks. Toronto, like numerous other cities, is experiencing coronavirus disease 2019 (COVID-19) outbreaks in homeless shelters.(5)

Approximately 235,000 individuals experience homelessness in Canada annually, though the actual number may be much higher.(6) According to the nationally coordinated 'Point-in-Time (PiT) Count of Homelessness in Canadian Communities' in 2018, 14% of homeless individuals identified as coming to Canada as immigrants, refugees, or refugee claimants.(7) Refugee claimants, elsewhere known as asylum seekers, arrive to Canada seeking safety from persecution. In 2019, 58,378 claimants sought refuge in Canada.(8) The majority of refugee claimants spend several months in shelters while they seek independent housing. We report an outbreak response to COVID-19 at one of the largest refugee shelters in Toronto and the clinical epidemiology of infection in this population.

Methods

Setting

A COVID-19 outbreak occurred at a downtown shelter that provides temporary housing to refugee claimants and can accommodate approximately 90 people across two of its linked emergency shelter sites. Residents live in shared rooms with 2 to 6 people, which include shared bathrooms, and eat prepared meals in a shared dining room. The Crossroads Refugee Clinic at

Women's College Hospital (WCH) has a long-standing partnership with this shelter, including an on-site shelter-based primary care clinic run by Crossroads Refugee Clinic. Refugee claimants receive health care coverage through the Interim Federal Health Program (IFHP), which provides comprehensive coverage for basic medical services, including physician consultations, laboratory tests, diagnostic imaging, and hospital services, similar to Canadian public provincial health insurance, and supplementary coverage for medications and other services and devices, similar to coverage through provincial social assistance programs.(9) During COVID-19, the Ontario government expanded health care coverage to all individuals, regardless of health insurance or immigration status.(10)

Outbreak response and clinical follow-up

In response to a COVID-19 outbreak at this refugee shelter, the Crossroads Refugee Clinic and WCH's mobile COVID-19 testing team were invited to support on-site SARS-CoV-2 testing and post-testing management for shelter residents. On April 20, 2020, adults aged 18 and older residing at the shelter were offered SARS-CoV-2 testing with nasopharyngeal swab. Twenty-four of the total 87 shelter residents were off-site in isolation facilities at the time of testing and were excluded from this study, including 10 individuals previously diagnosed with COVID-19 and 14 individuals identified as close contacts. Nasopharyngeal swabs were performed by WCH clinicians and sent for SARS-CoV-2 polymerase chain reaction (PCR) testing. At the time of testing, clinicians screened each participant for the presence of three typical COVID-19 symptoms: fever, cough, and shortness of breath.

On April 21, 2020, the clinical team conducted a more detailed clinical assessment for those individuals who tested positive for SARS-CoV-2, including measurement of vital signs and open-ended questioning regarding COVID-19 symptoms, date of symptom onset, and past medical history. Individuals who tested positive were transferred to a COVID-19 isolation facility with on-site medical support for 14-day isolation.

Fourteen days after testing, individuals who tested positive were phoned by the clinical team for reassessment, including a standardized screen for the presence of 15 symptoms (see table 2) at any time during the preceding two weeks and on day 14 post-testing. The 15-item symptom screen was based on Centre for Disease Control (CDC) list of COVID-19 related symptoms,(11) as well as other symptoms emerging in the literature at the time of assessment.(4)

Data extraction

Data was manually extracted through retrospective chart review of electronic medical records (EMR), including scanned documents, and a paper-based record of shelter residents and test results. Data was entered into an Excel spreadsheet by VR and a research assistant. Selected variables included basic demographic factors (age and sex), SARS-CoV-2 PCR test results, symptoms at the time of testing (fever, cough, shortness of breath), and symptoms one day after testing and on reassessment 14 days post-testing (15-item symptom screen).

Statistical analysis

Descriptive statistics, including counts, proportions, means, and standard deviations, were calculated using Microsoft Excel software.

Ethics approval

This study was approved by the WCH Research and Ethics Board, with a waiver of informed consent.

Results

Sixty out of 63 residents on-site at the shelter underwent SARS-CoV-2 testing and basic symptom screening on April 20, 2020. The mean age of participants was 37.1 years and 80% were male (Table 1). Twenty-five individuals (41.6%) tested positive for SARS-CoV-2. At the time of testing, 6 (10%) individuals screened positive for fever, cough, or shortness of breath that same day. Five of the 6 individuals who reported symptoms were found to have positive SARS-CoV-2 tests.

On April 21, 2020, upon more detailed clinical assessment among those who tested positive, 17 of 24 (70.8%) reported at least one symptom consistent with SARS-CoV-2 infection. Headache (33.3%), fever (28%), and myalgias (25%) were the most commonly reported symptoms (Table 2).

During the two weeks following testing, 21 of 24 (87.5%) individuals reported experiencing at least one symptom consistent with SARS-CoV-2 infection. The most commonly reported symptoms were headache (58.3%), loss of taste (41.7%), loss of smell (29.2%), and myalgias (25%). On day 14 post-testing, 9 (37.5%) reported the presence of at least one symptom: loss of

taste (12.5%) and myalgias (8.3%) were most common. We could not reach one individual until day 15 post-testing, but responses reflected symptoms over the preceding 14 days.

One patient who tested positive for SARS-CoV-2 was sent to the emergency department at the time of testing to rule out malaria due to documented fever and headache and origin from a malaria endemic region. His test for SARS-CoV-2 subsequently returned positive and he was discharged from the emergency department but we were unable to reach the patient for reassessment. A single hospitalization was related to isolation requirements rather than clinical severity; the patient was subsequently discharged to a COVID-19 isolation facility. There were no cases of intensive care unit admission, intubation, or death. All SARS-CoV-2 positive residents recovered after 14 days of isolation in the COVID isolation facility with low acuity symptomatic management.

Interpretation

We found a high incidence of SARS-CoV-2 infection (41.6%) on universal testing of on-site shelter residents. The overall estimated positivity rate among all 87 residents is likely higher, accounting for individuals who tested positive prior to April 20, 2020 and thereafter.(5) While a minority (20%) of individuals with SARS-CoV-2 infection reported a narrow range of symptoms at the time of testing, the majority (87.5%) developed mild symptoms during the subsequent 14 days.

These findings are consistent with high infection rates found in other shelter settings where testing followed identification of a cluster of COVID-19 cases: 36% of shelter residents tested

positive for SARS-CoV-2 in a shelter in Boston, 66% in a shelter in San Francisco, and 17% across 3 shelters in Seattle.(1,2) Common public health interventions to contain COVID-19 spread, such as physical distancing, hand hygiene, timely testing, contact tracing, isolation, and use of personal protective equipment may be challenging to implement among many people experiencing homelessness, given physical constraints of shelter settings, limited access to supplies, and concurrent mental and physical health conditions.(12) Proactive measures, including increased physical spacing between shelter beds, decreased density within each shelter through opening additional accommodation facilities, isolation centres for homeless individuals testing positive for SARS-CoV-2, and on-site assessment and testing with rapid turnaround of test results, have been shown to help mitigate the risk of COVID-19 outbreaks in other shelter settings.(13) Collaboration among public health units, local government, shelter operators, and health providers are key.(13)

Few individuals with SARS-CoV-2 infection in our study filled criteria for prior, narrowly defined COVID-19 symptoms (fever, cough, shortness of breath) at the time of testing. This is consistent with findings from a shelter outbreak in Boston, in which a minority of shelter residents with SARS-CoV-2 infection had fever (0.7%), cough (7.5%), or shortness of breath (1.4%) upon testing.(1) However, most individuals with SARS-CoV-2 in our study (87.5%) subsequently developed a range of symptoms consistent with infection during the 14 day period after testing, which were identified on more detailed clinical assessment. Similarly, a study of a COVID-19 outbreak at a call centre in South Korea demonstrated that only 4.1% of 97 infected individuals remained completely asymptomatic during a 14 day post-testing period,(14) which is much lower than the previously estimated asymptomatic ratio of 30.8% based on earlier

modeling.(15) Another study of a long-term care skilled nursing facility in Seattle found that among 13 residents who tested positive for SARS-CoV-2 and were asymptomatic at the time of testing, 10 went on to develop symptoms one week following testing.(16) These findings underscore the value of enhanced surveillance for SARS-CoV-2 testing in high-risk settings, such as shelters, particularly in light of mounting evidence of paucisymptomatic and presymptomatic spread.(4,16,17,18) Our study also emphasizes the importance of evaluating for diverse symptoms suggestive of infection.

The majority of shelter residents in our study had mild to moderate clinical courses, which may reflect the relatively young age of this sample and low prevalence of pre-existing comorbidities. In the general homeless population, many individuals are older and have underlying health conditions, increasing their risk of severe COVID-19-related complications.(12,19,20)

Our findings also highlight the importance of ensuring access to testing and medical treatment for all, regardless of immigration or health insurance status. This is particularly poignant as we witness SARS-CoV-2 outbreaks in other forms of congregate settings, including among migrant farm workers who are often working and living in crowded conditions and have precarious employment, immigration, and health insurance status.(21–23)

Limitations

This study describes COVID-19 test results and individuals' clinical courses at a single homeless shelter. Not all residents were present at the time of SARS-CoV-2 testing and subsequent test results completed after April 20, 2020 were not available to the research team. Rates of SARS-

CoV-2 infection and clinical courses may be highly variable across different shelter settings and homeless populations.

While we conducted limited symptom screening on day 1, comprehensive clinical assessment on day 2, and retrospective symptom evaluation on day 14, daily comprehensive symptom screening may have provided a more accurate depiction of symptom emergence and evolution during the study period, and the day 14 symptom screen is prone to recall bias.

Conclusion

Our study underscores the high risk of SARS-CoV-2 transmission in congregate living settings. We also found that most individuals with SARS-CoV-2 infection developed compatible symptoms of COVID-19, although most had mild symptoms. Our findings highlight the importance of mobilizing timely testing and management of all residents of shelters where infection is present, including symptomatic, paucisymptomatic, and asymptomatic (including those who are presymptomatic) residents. Tailored strategies are critical to respond to the unique needs of homeless and refugee populations to decrease risks of transmission and manage cases of infection in congregate settings. Alongside these COVID-19 mitigation interventions, there is a pressing need for upstream action to address the root causes of homelessness.

Data sharing: A deidentified data set from the study may be made available to other researchers who provide a detailed study proposal clearly describing the use of the data and that is approved by an independent review committee. Researchers who wish to access the study data may contact the corresponding author, Vanessa Redditt, at vanessa.redditt@wchospital.ca.

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Conflicts of interest: Vanessa Redditt is on the volunteer community board of directors of Sojourn House. Isaac Bogoch has consulted to BlueDot, a social benefit company that tracks emerging infectious diseases.

Contributors: All authors were involved in the conception of the paper and study design. Vanessa Redditt collected, analysed, and interpreted the data and drafted the manuscript. All of the authors contributed to data interpretation, revised the manuscript critically for important intellectual content, approved the final version to be published, and agreed to be accountable for all aspects of the work.

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Table 1. Characteristics and initial symptoms of shelter residents who underwent SARS-CoV-2 testing on Apr 20, 2020

Characteristics	No. (%)		
	All Residents (n=60)	**Residents with Positive SARS-CoV-2 swab (n=25)**	**Residents with Negative SARS-CoV-2 swab (n=35)**
Age, mean (SD), years	36.0 (10.0)	38.7 (11.0)	34.1 (8.8)
Sex			
Male	48 (80)	22 (88)	26 (74.3)
Female	12 (20)	3 (12)	9 (25.7)
Symptoms at time of testing			
Fever	3 (5)	2 (8)	1 (2.9)
Cough	3 (5)	3 (12)	0
Shortness of breath	0	0	0

Table 2. Clinical symptoms of shelter residents who tested positive for SARS-CoV-2 testing on Apr 20, 2020 (n=24)[a]

Clinical symptoms	No. (%)		
	On day 1 post-testing	Any time during 14 days post-testing	On day 14 post-testing
Asymptomatic	7 (29.1)	3 (12.5)	15 (62.5)
Any symptoms	17 (70.8)	21 (87.5)	9 (37.5)
Fever	7 (29.1)	8 (33.3)	0
Cough	6 (25)	5 (20.8)	1 (4.2)
Shortness of breath	0	1 (4.2)	0
Chills	2 (8.3)	3 (12.5)	0
Myalgias	6 (25)	6 (25)	2 (8.3)
Headache	8 (33.3)	14 (58.3)	0
Sore throat	6 (25)	6 (25)	0
New loss of taste	1 (4.2)	10 (41.7)	3 (12.5)
New loss of smell	1 (4.2)	7 (29.2)	0
New nasal congestion	1 (4.2)	6 (25)	1 (4.2)
Diarrhea	1 (4.2)	3 (12.5)	0
Malaise	3 (12.5)	5 (20.8)	1 (4.2)
Dizziness	1 (4.2)	4 (16.7)	1 (4.2)
Nausea and/or vomiting	0	2 (8.3)	1 (4.2)
Chest pain/tightness	1 (4.2)	4 (16.7)	0
Other	3 (12.5)	8 (33.3)	2 (8.3)

[a] One individual could not be contacted after initial testing.