Coronavirus Disease 2019 (COVID-19) Outbreak in a San Francisco Homeless Shelter

Elizabeth Imbert, MD, MPH (1)

Patrick M. Kinley (2)

Ashley Scarborough, MPH (2)

Caroline Cawley, MPH (3)

Madeline Sankaran, MPH (2)

Sarah N. Cox, MSPH (2)

Margot Kushel, MD (4)

Juliet Stoltey, MD, MPH (2)

Stephanie Cohen, MD, MPH (1,2)

Jonathan D. Fuchs, MD, MPH (2,5)

For the SF COVID-19 Response Team

1. University of California, San Francisco, Division of HIV, ID and Global Medicine

2. San Francisco Department of Public Health

3. University of California, San Francisco, Department of Emergency Medicine

4. University of California, San Francisco, UCSF Center for Vulnerable Populations;

Zuckerberg San Francisco General Hospital

5. University of California, San Francisco, Department of Medicine

Corresponding author: Elizabeth Imbert

Elizabeth.imbert@ucsf.edu; 917-318-2543

Abstract

We report the public health response to a COVID-19 outbreak in a San Francisco shelter where 67% of residents and 17% of staff tested positive for SARS-CoV-2. We describe the limited utility of case investigation, person-based contact tracing and symptom screening, and the benefits of mass testing in outbreak response.

Introduction

On a single night, approximately 568,000 people experience homelessness (PEH) in the United States, two-thirds (63%) of whom utilize shelters (1). COVID-19 may spread easily among homeless shelter residents and staff. Outbreaks have been reported across the United States (2). Given PEH are older than the general population and experience comorbidities (3), this population is at increased risk of severe coronavirus disease 2019 (COVID-19).

On March 5th, San Francisco identified the first confirmed case of community transmission. The San Francisco Department of Public Health (SFDPH) provided guidance to prevent the transmission of COVID-19 among PEH including infection control measures, meal and bathroom staggering, reduction of group activities, symptom screening, and masking for symptomatic residents and staff working with them. The city launched the COVID-19 Alternative Housing Program to provide emergency, temporary housing for individuals directly affected by or at high risk for severe COVID-19 (4).

In April, SFDPH responded to an outbreak of COVID-19 in the largest homeless shelter in San Francisco. The shelter, a 44,769 square feet facility, has three floors with beds located 1.5–3 feet apart. Shelter policy required residents to leave the shelter in the morning and return at night. On March 27th, staff and residents started receiving daily temperature checks and staff assessed if residents "looked sick". The following week, staff began to screen residents for new symptoms (cough, fever, or difficulty or pain with breathing). If residents screened positive, they were not admitted to the shelter. If staff screened positive, they were instructed to go home. Here, we describe the lessons learned from our public health response to a COVID-19 outbreak that occurred.

Methods

Determination of the at-risk period

On April 5th, two symptomatic residents tested positive for COVID-19. One presented to urgent care on March 31st. Temperature checking and symptom screening by shelter staff identified another on April 4th. We defined the at-risk period as starting two days before symptom onset of the index case, March 29th, and ending April 11, when the SFDPH decided to close the shelter. (5). We identified 255 residents and 64 staff present at the shelter during the at-risk period.

Data collection and analysis

We extracted age, sex, race/ethnicity, comorbidities, emergency department visits, hospitalizations, and deaths from a city-wide administrative database, the Coordinated Care Management System (CCMS), an integrated database maintained by SFDPH that includes county medical and behavioral health electronic health records, as well as data related to housing status, shelter use, benefits, and mortality (6). Symptom information was extracted from case interviews and isolation and quarantine (I&Q) hotel referral forms. SFDPH clinical staff collected nasopharyngeal specimens, and samples were tested for SARS-CoV-2 using the Abbott m2000 reverse transcription-polymerase chain reaction (RT-PCR) assay at San Francisco's Public Health Laboratory.

We used descriptive statistics to characterize the study population; percentage of positive PCR tests; and symptoms, emergency department visits, hospitalizations, and deaths of confirmed cases. The University of California, San Francisco approved this work under expedited review. We conducted analysis using SAS System (SAS Institute Inc., Cary, NC).

Results

Shelter population

Of the 255 residents, 65 (25%) had a co-morbidity associated with increased risk of severe COVID-19, the most common of which were hypertension, chronic pulmonary disease, and diabetes. The median age of the residents was 54 years (range 22-77). Among these, 215 (84%) were male; 79 (31%) were Black, 65 (25%) were White, 46 (18%) were Latinx; 12 (5%) Asian Pacific Islander and 53 (21%) had an unknown race/ethnicity.

Outcomes of case investigation, contact tracing, and symptom screening

In response to the notification of two positive COVID-19 cases, we conducted case investigations on April 6th and 7th, eliciting close contacts and identifying bedmates within six feet of the index cases. The two index cases described a total of four close contacts. They were able to provide physical descriptors, such as approximate age, race, and gender but did not have complete names or contact information. We were unable to identify or offer testing to any of these elicited close contacts. A total of 26 beds were located within six feet of the index cases, but only 18 of those beds were occupied. We located eight (44%) bedmates who agreed to symptom screening and testing. Five of these bedmates reported symptoms (three tested positive, one tested negative, and one refused testing for SARS-CoV-2). Three asymptomatic bedmates were not initially offered testing (one later tested on April 12th and returned positive). Additionally, temperature checks and symptom screening by SFDPH staff identified two symptomatic residents who tested positive for SARS-CoV-2. Non-SFDPH providers notified us of two additional positive symptomatic cases. In total, seven additional COVID-19 cases were identified through testing performed on April 6th and 7th.

Outcomes of mass testing

On April 8th and 9th we attempted to test all residents and staff in the shelter. We did not document refusals. We closed the shelter on April 11th and continued testing through April 15th for those who were moved to I&Q hotels. We did not test remaining residents due to limited testing supply. We received additional results of staff and residents who underwent testing with other non-SFDPH providers (See Figure 1, Panel A).

In total, we tested 150 out of the 255 residents, of which 101 (67%) were positive and 100 had recorded symptom data (See Figure 1, Panel B). One resident tested positive post-mortem; we do not have symptom data. Fifty-two (52%) were asymptomatic at time of testing. One-fifth (21%) were age 60 or older, and 27% had underlying medical conditions. The most common comorbidities were hypertension, diabetes, and congestive heart failure. Of residents who were symptomatic, five individuals had symptoms that preceded the index cases with the earliest symptom onset on March 28th. Of the 60 staff tested, 10 (17%) were positive. Among the seven staff with recorded symptom data, five were symptomatic at the time of testing with the earliest symptom onset of April 3rd. No staff listed any residents as close contacts.

After the shelter closed, 190 residents (75%) moved to I&Q hotel rooms, including 100 (99%) of those who tested positive. Of those residents who tested positive, 12 (12%) had treat and release emergency department visits, eight (8%) required hospitalization, and one died. The median age of hospitalized and not hospitalized cases were 49 (range 28-73) and 48 (range 22-76), respectively (p=.90, Wilcoxon rank sum test). Three (38%) hospitalized cases had a co-morbidity identified compared to 25 (27%) of those who were not hospitalized

(p=.26, Two proportions z-test). Among the positive residents, 53 (52%) completed a case interview; the remainder could not be contacted.

Discussion

This outbreak demonstrates the high risk of transmission of COVID-19 in homeless shelters, as well as the limited utility of a public health response that focused solely on identifying bedmates within six feet and reported close contacts. Person-based contact tracing did not identify new cases due to vague close contact descriptions, reinforcing CDC's recommendations to pursue location-based contact tracing among PEH (7). Cases were widely distributed throughout the shelter, reinforcing the risks of congregate living and highly populated shelters without capacity for social distancing.

This outbreak demonstrates that waiting for detection of a symptomatic case may be too late to prevent superspreading events (8). The high proportion (52%) of asymptomatic cases among residents at the time of testing suggests symptom screening is insufficient to detect SARS-CoV-2 prevalence in shelters (9). Furthermore, the outbreak occurred during a period of low community incidence of disease (5.7 cases per 100,000 persons per day), which illustrates that superspreading events in shelters can occur despite low community incidence (2). Active surveillance in shelters may increase case detection during the infectious pre-symptomatic phase of infection and reduce the likelihood of transmission events (10). Identification of cases through expanded testing should be done in conjunction with a clear strategy for isolating and quarantining confirmed positives and their close contacts.

Limitations of this report include its cross-sectional nature at a single shelter in San Francisco. Additionally, given the poor case interview completion rate and the limited number of close contacts identified, we cannot fully assess the epidemiological links between

cases. Also, identification of confirmed cases with symptoms preceding those of the index cases suggests that the entire at-risk population is not completely represented, and furthermore, of the at-risk population we defined, only 155 (59%) were tested. In addition, some residents may under-report symptoms for fear of losing their shelter. Furthermore, we were unable to discern whether individuals asymptomatic at the time of testing subsequently developed symptoms.

Conclusions

This outbreak demonstrates the limited utility of case investigation, person-based contact tracing, and symptom screening, and the benefits of mass testing in outbreak response. Future research is needed to evaluate the utility of various preventative measures (masking, reduced shelter density, improved ventilation and sanitation, or shelter-in-place policies) to prevent future outbreaks of COVID-19 among PEH. We must take the lessons learned from this outbreak to prevent future transmission, as well as morbidity and mortality from COVID-19, among this vulnerable population.

Notes:

The authors listed have no conflict of interest.

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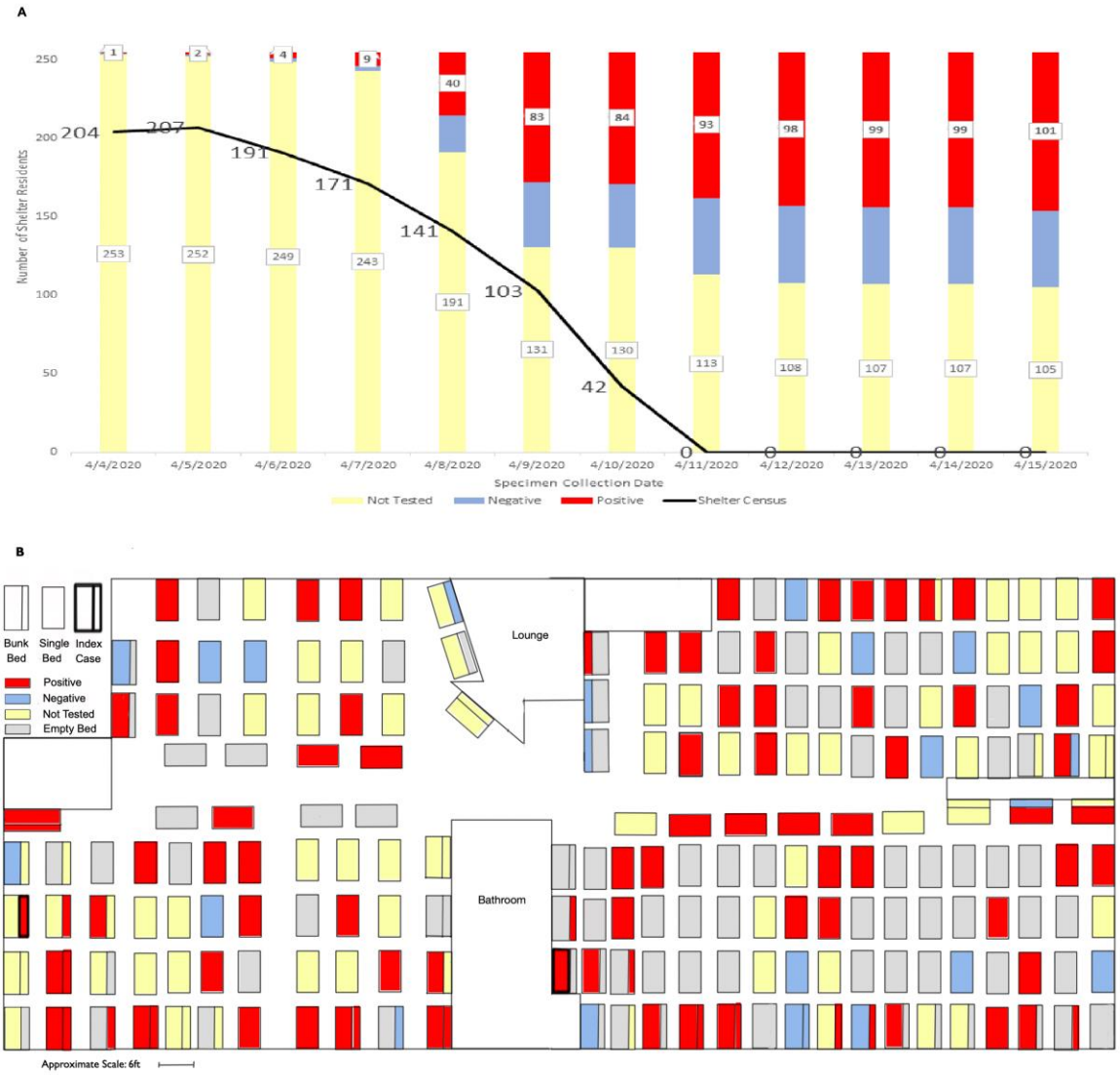
Figure Legend:

Figure 1*.Testing outcomes for COVID-19 outbreak in a San Francisco homeless shelter.* Panel A shows the number of positive and negative results, as well as the proportion of those who were not tested among the at-risk resident population, during each day of the public health outbreak response. In addition, the daily shelter census is shown as a black trend line. Panel B is a visual depiction of the final SARS-CoV-2 testing outcomes on the second floor of the homeless shelter where 89 out of 101 cases were found (10 cases on the 1st floor and 2 cases in the basement were also identified, but are not pictured here). For both figures, positive tests are depicted in red, negative tests are depicted in blue, and residents who were not tested are represented in yellow.

Figure 1


A
Number of Shelter Residents
Specimen Collection Date
4/4/2020
4/5/2020
4/6/2020
4/7/2020
4/8/2020
4/9/2020
4/10/2020
4/11/2020
4/12/2020
4/13/2020
4/14/2020
4/15/2020
204
207
191
171
141
103
42
0
Not Tested
Negative
Positive
Shelter Census
B
Bunk Bed
Single Bed
Index Case
Positive
Negative
Not Tested
Empty Bed
Lounge
Bathroom
Approximate Scale: 6ft