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Case Report

Cardiac Related Deaths among Homeless with Covid-19: Case Presentations -

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ABSTRACT

Background: Homeless individuals and families living in- or around homeless shelters who are diagnosed with Cardiovascular Disease (CVD) and COVID-19 have an increased risk for severe illness and even death.

Local problem: Homeless and underserved populations in South Florida are faced with medically complex needs that are partially met by onsite clinics. Unfortunately, the COVID-19 pandemic has further limited access to onsite clinic and hospital outpatient services, adversely impact quality of life, resulting in a cost burden to the healthcare system.

Methods: The shelter and clinic staff implemented a rapid 6-step process to reduce the spread of COVID-19 among persons living at the shelter which included in-service training and education on COVID-19, physical spacing, symptom identification, quarantining positive cases for 14-days, cleaning and disinfecting common areas, and partnering with local health departments.

Results: Descriptive statistics were used to examine the data. Findings showed that 372 SARS-CoV-2 tests were performed on sheltered and unsheltered homeless persons living in- or around the homeless shelter and onsite clinic. Of the 372 tests performed in 294 individuals, 54 (15%) sheltered and unsheltered persons tested positive (the 54 includes two retest) and 242 (62%) tested negative. Of the 52 homeless persons who tested positive for SARS-CoV-2, 4 (1%) died, 2 (< 1%) were re-infected with COVID-19, two patients are currently hospitalized at the writing of this article, and 108 persons were placed in quarantine, which included persons exposed during contact tracing.

Conclusions: Homelessness increases the prevalence of SARS-CoV-2 transmission, especially in patients with CVD, but varies among shelter character based upon agency policies. Early detection of SARS CoV-2 is essential among homeless populations to identify clusters, decrease viral transmission, increase early treatment and access to health care services, and to protect staff members and workers from exposure.

Keywords: Homelessness; COVID-19; Cardiovascular diseases; Death

INTRODUCTION

The United States (U.S.) and other countries around the world are facing an outbreak of a newly identified coronavirus that presented as an acute respiratory illness originating in Wuhan, China in December, 2019 [1]. On January 31, 2020, the U.S. Health and Human Services (HHS) issued a declaration of a public health emergency related to the coronavirus and mobilized the Operating Divisions of HHS (Health and Human Services (HHS), 2020) [1]. The World Health Organization (WHO) labeled this newfound coronavirus disease as COVID-19 on February 11, 2020, and the virus was categorized under SARS-CoV-2 [1-3,4]. In addition, on March 13, 2020, President Trump declared a national emergency in response to COVID-19, following reports from the Centers for Disease Control and Prevention (CDC) and the Corona virus Task force, which stated that SARS-CoV-2 showed the ability to rapidly spread among people, leading to significant adverse effects on healthcare systems and local communities nation-wide [5-8]. This public health threat required rapid detection of cases and contacts, appropriate clinical management, infection control, and community mitigation efforts for all, especially vulnerable homeless populations [9]. This article will describe the plight of homeless persons living in south Florida during the COVID-19 pandemic and present two cases of homeless persons living in a homeless shelter who died after contracting COVID-19.

Background

Cardiovascular Disease (CVD) is the leading cause of death in the United States, followed by cancer, and now COVID-19, which is the third leading cause of death ahead of injuries, accidents, lung disease, diabetes and Alzheimer's [10-11]. CVD is responsible for over 655,000 American deaths yearly, estimated at 1 in every 4 deaths, and generates an annual healthcare cost of approximately $219 billion [12]. In contrast, COVID-19 has caused more than 200,000 deaths in the U.S., impacting over 1000 lives weekly [13,14]. According to Avalere Health [15], "analysis of hospital stay claims in Medicare Fee-For-Service (FFS) found that total costs to the U.S. healthcare system from inpatient hospitalizations due to COVID-19 will range from $9.6B to $16.9B in 2020."

Individuals diagnosed with CVD and COVID-19 has an increased risk for severe illness and even death. The risk for worsening morbidity and mortality increases with age (50, 60, 70, and 80+ years), other comorbid conditions such as Diabetes Mellitus (DM), obesity, renal disease, and poor socioeconomic conditions, as seen among homeless persons living in- or around homeless shelters (see Figure 1, National Center for Health Statistics (NCHS) Mortality Reporting System) [16-20].

In a retrospective study of 113 deceased patients who died from the coronavirus [21], found that patients who died from coronavirus were older with a median age of 68 years compared to those who recovered from coronavirus with a median age of 51 years. The study also showed that males died at a higher rate (73%) from coronavirus than those who recovered at 53%. More consistent with current findings were the comorbid conditions found among the deceased, showing increases in Hypertension (HTN) and other CVDs. Upon admission, the deceased persons presented with shortness of breath, chest tightness, and decreased mental status. The median time of patients diagnosed with coronavirus to death was 16 days, with an interquartile range of 12.0-20.0 days. Laboratory findings showed leukocytosis (50%) in patients who died along with concentrations of Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Creatinine, Creatinekinase (CK), Lactate Dehydrogenase (LDH), Cardiac Troponin I, N-Terminal Pro-Brain Natriuretic Peptide (NT-proBNP), and D-dimer which were markedly higher in deceased patients than in recovered patients [21].

The Problem among homeless persons:

In America, there are approximately 1.4 million people needing emergency shelter or transitional housing annually [16]. Florida is ranked number three in the nation with 28,328 reported homeless persons, behind New York with 92,091, and California with 151,278 [22]. As of 2019, Miami-Dade County (MDC) had the highest number of homeless populations in Florida with 3,472 on a given night (2,464 sheltered and 1008 unsheltered) [23].

Homeless and underserved populations in south Florida are faced with medically complex needs that are partially met by onsite clinics usually affiliated with the Florida Association of Free and Charitable

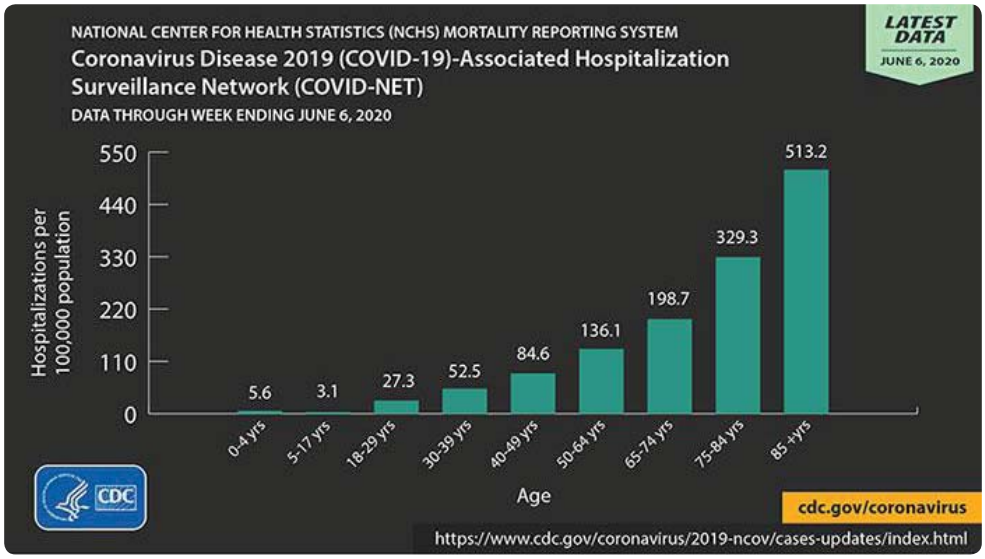

Figure 1: National Center for Health Statistics (NCHS) mortality reporting system.

Clinics [24]. Hospitals and emergency departments are frequently the point of entry for the homeless experiencing health care needs [25-26]. Unfortunately, the COVID-19 pandemic has further limited access to onsite clinic and hospital outpatient services. Homeless persons are also unable to receive private health care due to an inability pay for the office visit. Therefore, follow up care and recovery support are minimal and adversely impact quality of life, resulting in a cost burden to the healthcare system [26].

People are homeless because they have no permanent dwelling or an affordable place to live [27]. Many persons who experience chronic homelessness also experience chronic health issues and there is no single entity or set of factors that separates individuals who are homeless from those with homes [24]. However, group shelters and congregant living facilities can create health care issues that must be addressed, mainly exposure to COVID-19 and other vaccine preventable illnesses such as pneumonia, influenza, meningococcal, diphtheria, pertussis, chicken pox, measles, mumps, rubella, and hepatitis [26].

METHOD

In early April, our local men's shelter implemented procedures to reduce the spread of COVID-19 among persons living at the shelter. Immediately, all residents and staff received in-service training on hand washing, wearing protective face coverings, social distancing, and reporting any signs or symptoms of fever, cough, or shortness of breath. Next, 6-foot spacing was created in the dormitories, cafeteria, auditorium, and in the onsite clinic. Appropriate sanitation measures were implemented to include the United States Environmental Protection Agency (EPA) approved disinfectants [28]. Hand sanitation stations were strategically placed in all corridors, dorm rooms, cafeteria, and medication room and entry areas to the shelter. No new admissions were allowed once the "Stay-at-home" orders were given by Florida's Governor, Ron DeSantis on April 1, 2020 [29]. The local Department of Health (DOH) teamed up with the onsite clinic staff to conduct coronavirus testing using nasopharyngeal swabs daily, Monday through Friday. The clinic staff tested shelter staff and homeless persons living in and around the shelter for 3-months, along with persons identified through contact tracing. COVID testing was performed by the DOH selected laboratory using the cobas (R)for SARS-CoV-2, the virus that causes COVID-19, Reverse Transcription – Polymerase Chain Reaction (RT-PCR) testing authorized by the Food and Drug Administration (FDA) under an Emergency Use Authorization (EUA) [30].

INTERVENTION

Because there were initial delays in obtaining appropriate Personal Protective Equipment (PPEs) and other needed supplies, clinic staff was reduced to essential personnel, which included the physician, physician assistant, nurse practitioner, clinic administrator and clinic medical assistants. During the initial outbreak of COVID-19, shelter and clinic staff maintained high vigilance of any reported symptoms that might indicate COVID-19 exposure among the sheltered homeless residents, such as fever with a temperature above 100.4 F (Fahrenheit), cough, or Shortness of Breath (SOB). Any person reporting the listed symptoms or suspected of being positive for COVID-19 was assessed, tested, and separated from other residents until confirmation results were delivered [8]. If positive, the resident was quarantined for 14-days in a single-room hotel designated for homeless persons testing positive for SARS-CoV-2, the virus that causes COVID-19. Prior to returning to the shelter, residents were retested for SARS-CoV-2, following guidelines from the FDA [30] matrix for interpreting test results (see Table 1. SARS-CoV-2 Test Results Matrix). Although there are several coronavirus vaccines currently in Phase three testing, to-date, there is no vaccine available to treat COVID-19; instead, care was aimed at supporting the resident, relieving their symptoms, and controlling the spread of the virus to others [31]. The FDA requires all coronavirus test be validated before use to avoid the negative impact of false results on the resident and broader public health implications. Recommendations on testing were provided by the FDA to ensure analytical and clinical validity [30]. Rapid detection of COVID-19 cases in America require wide availability of testing to control the emergence of this rapidly spreading, severe illness. Guidance provided by the FDA [30], describes a policy for laboratories and commercial manufacturers to help accelerate the use of tests developed to achieve more rapid and widespread testing capacity in the United States. The FDA anticipates

Table 1: SARS-CoV-2 test results matrix.

True Positive Person has disease and test positive	True Negative No disease and test are negative
False Positive No disease and test positive	False Negative Person has disease and test negative

that 100% of published SARS-CoV-2 sequences will be detectable with the selected primers and probes. Molecular tests detect viral genetic material and includes: (1) Nucleic acid amplification test (NAAT) and (2) RT-PCR test. The FDA also defines SARS-CoV-2 serological tests as antibody testing from clinical specimens for Immune Globulin G (IgG) and Immune Globulin M (IgM) to SARS-CoV-2 [30]. The local DOH provided the cobas (R) for SARS-CoV-2, RT-PCR testing for the residents of the homeless shelter with a turn-around time not exceeding 72-hours.

RESULTS

The homeless shelter enrollment at the start of the COVID-19 pandemic was 328 sheltered men. By the end of August 2020, shelter enrollment had dropped to 128 male residents, representing a 39% drop in enrollment due to the transient behaviors of homeless persons. Due to the COVID-19 pandemic, persons leaving the shelter were not allowed to return until the number of positive cases in MDC was below 10%. The number of unsheltered homeless men who lived on the sidewalk adjacent to the shelter varied each day, again to the transient nature of this population. The onsite clinic staff assisted by the local DOH staff, provided 372 corona virus testing to 294 sheltered and unsheltered homeless persons living in and around the homeless shelters and conducted 362 wellness telephone encounters. Mobile telephones were provided by the local Homeless Trust to homeless persons quarantined, thus allowing daily communication with each quarantined victim for wellness checks. Seventy (70) individuals were tested more than one time. The vast majority of the individuals were male (86%, 248 Individuals) and the average age of the individuals tested were 49.2 years.

Of the 372 tests performed, 54 (15%) of sheltered and unsheltered persons tested positive for SARS-CoV-2 ; 88 (24%) of the 372 tests performed were conducted on unsheltered homeless persons;47 (17%) persons recovered from COVID-19 (included unsheltered persons); 4 (1.4%) persons died; 2 (< 1%) persons were re-infected with COVID-19;two patients are currently hospitalized at the writing of this article; and 108 persons were placed in quarantine, which included persons exposed during contact tracing (see Figure 2 and Table 2).

Among the four deaths from the homeless shelter, three were confirmed COVID-19 positive and one unconfirmed. The three confirmed COVID-19 deaths occurred within 6-days of each other. The ages of the victims ranged between 56 to 75 years of age. Each victim had preexisting conditions and were being treated at the onsite clinic prior to hospitalization for diabetes mellitus, obesity and HTN. The fourth homeless death occurred one-month following the first three deaths and was unconfirmed for COVID-19. All victims were males; three were non-Hispanic Blacks and one Hispanic. Each of the three deaths presented to the ER with SOB, fever and cough; admitted to telemetry or the intensive care unit where their conditions deteriorated rapidly; and decompensated requiring increased oxygen and later intubation. Two of the four deaths are presented below and fictious initials are used to protect the patients' identities.

Case 1. AH

A 56-year-old Black male living at the homeless shelter presented with new onset of fever, non-productive cough and SOB upon awakening. The Emergency Medical System (EMS) was called and the patient transported to the nearest ER for evaluation and treatment. The patient had not previously tested positive for COVID-19.

History: The patient had a past medical history of Diabetes Mellitus (DM), obesity, and HTN, but no documented history of renal disease. The patient was followed for his medical conditions at the homeless shelter's free onsite clinic. He was taking Lisinopril 5 mg daily and Metformin 500 mg twice daily. His last recorded weight was 213 pounds with a Body Mass Index (BMI) of 34.3 (see Table 3).

Hospitalization: Upon arrival to the ER, the patient's chief complaint was SOB, fever, and cough. The patient tested positive for COVID-19 and was placed on a COVID-19 inpatient unit, where he continued to decompensate with increased oxygen demands. Direct physical exam in the hospital was deferred to mitigate exposure to COVID 19 during the current pandemic. However, a 10-point reviews of [1] systems was performed and found to be negative except as identified in the history of present illness (HPI). By day seven, the patient became hypoxemic, hypercapnic, developed respiratory failure secondary to COVID-19, was intubated, placed on hydrocortisone 50

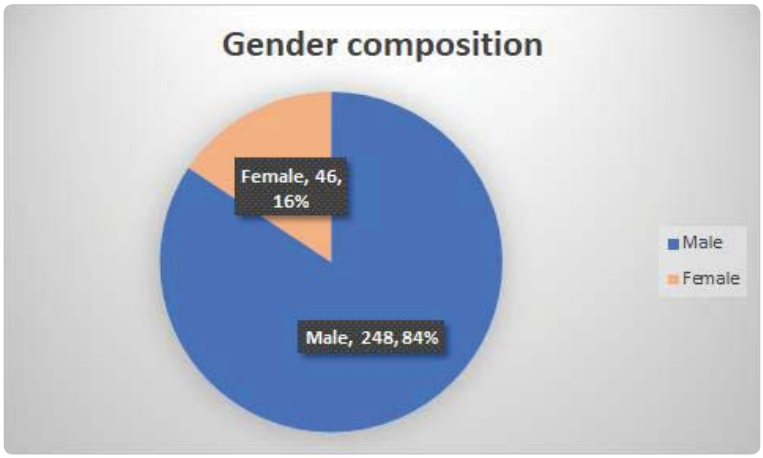

Figure 2: Demographics of the investigated sample.

Table 2: Testing results and individuals affected.

	N	%
Tests		
N	372	100%
Positive	54	15%
Negative	302	81%
STD/Lab	16	4%
Individuals		
N	294	
Positive	52	18%
Negative	240	82%
Individuals that tested positive		
Recovery	47	90%
Hospitalized	2	4%
Re-infected	2	4%
Deceased	4	8%

mg intravenous (IV) every 6-hours and Levophed for septic shock. He later expired on day twelve.

Case 2. LC

A 74-year-old Hispanic male whose residence was at the homeless shelter, recently tested positive for COVID-19 and was quarantined at a nearby hotel designated for COVID-19 positive homeless persons. LC complained of chest pressure for about 2-hours without nausea or vomiting the night before his admission to a local hospital. EMS was called and the patient transported to the nearest ER for evaluation and treatment.

History: The patient had a past medical history (PMH) of CAD, DM Type 2, HTN, Hyperlipidemia, anxiety, 5-previous myocardial infarctions, 4-open heart surgeries with stent placements, and a cardiac pacemaker for past 3-years. The patient was followed for his medical conditions at the homeless shelter's free onsite clinic and the local hospital outpatient cardiac service. L Chad not been taking any of his prescribed medications which included: Lasix 20 mg tabs daily, Novolin 70/30 subcutaneous suspension, and spironolactone 25 mg tablets daily.

Hospitalization: Upon arrival to the ER, the patient's chief complaint was chest pressure the night before but none at time of exam. Blood samples were taken for lab analysis, chest x-ray and Electrocardiogram (ECG) performed that was consistent with Congestive Heart Failure (CHF) and unchanged from previous studies. The patient was given Intravenous (IV) fluids and IV Lasix, medication for hyperkalemia, aspirin, and was admitted to telemetry for unstable angina. During his hospital stay, LC continued to decline. By day 16, the patient was incubated, placed on dialysis with an increase in Levophed administration at 200 mcg and Vasopressin at 0.8, later expiring on day 17.

DISCUSSION

The CDC identified four factors that increase individual risk and community spread of COVID-19: (1) crowded conditions, (2) close physical contact, (3) enclosed spaces and (4) the duration of the exposure [8]. Homeless persons are constantly predisposed to each of the above listed conditions. The CDC developed a COVID-19 prognostic tool that is based on data from the CDC Interim Clinical Guidance for Management of Patients with Confirmed Corona virus Disease to guide health care providers in the care and management of persons positive for SARS-CoV-2 [8]. The Chinese CDC reported a total of 44,672 case records classified as confirmed cases of COVID-19 (through positive viral nucleic acid throat swab samples [32]. The overall case-fatality rate was 2.3% (1023 deaths among 44,672 confirmed cases). Age was a strong risk factor for severe illness, complications, and death with the case fatality rate being highest among older persons. In addition, the case-fatality rate

Table 3: Case 1 patient data.

Vital signs and Measurements on Admission					
Temp: 37.9C	**BP: 104/50 mmHg**	**HR: 103 bpm**	**RR: 30 bpm**	**WT: 96.5kg**	**BMI: 34.6**
Laboratory Studies on Admission					
HGB	**12.4 g/dL**	**K+ mmo/L**	**5.2mmo/L**	**HbA1c**	**H 9.7% A1C**
Cr	H 5.8 mg/dL	Calc. GFR	10	GLU	H 239mg/dL
INR	1.39	TRIG	H 448 mg/dL	HDL	L 24 mg/dL

Table 4: Case 2 patient data.

Vital signs On Admission					
Temp: 37.0C	**BP: 83/26 mmHg**	**HR: 118 bpm**	**RR: 34 bpm**	**WT: 97 kg**	**BMI: 35.94**
Laboratory Studies on Admission					
HGB	**L8.2 g/dL**	**K+mmo/L**	**3.8mmo/L**	**HbA1c**	**H9.7% A1C**
Cr	H 2.00 mg/dL	Calc. GFR	32	GLU	H 311mg/dL
INR	1.25	TOT CHOL	L 129 mg/dL	HDL	L 24 mg/dL
LDL	67.4 mg/dL	TRIG	H 328 mg/dL	D-dimer	H 2.27 mcg/mL
pH	7.38	PCO2	L 38 mmHg	PO2	37 mmHg
HCO3	L 22 mmo/L	Hgb O2 Sat	L 71.7%	Sodium	L 132 mmo/L
Potassium	H 5.3 mmo/L	Chloride	L 97 mmo/L	Ejection fraction	40-45%

was elevated among those with pre-existing comorbid conditions, such as cardiovascular disease, diabetes, chronic respiratory disease, hypertension, and cancer [32]. The U.S.CDC also issued a report titled "Severe Outcomes among Patients with Corona virus Disease 2019 (COVID-19) – United States, February 12 – March 16, 2020" [33]. In this report, a total of 4,226 COVID-19 cases in the United States that occurred during February 12 – March 16, 2020 were analyzed by age group. Overall, 80% of deaths associated with COVID-19 were among adults aged ≥65 years with the highest percentage of severe outcomes among persons aged ≥85 years. In contrast, no ICU admissions or deaths were reported among persons aged ≤19 years [33]. Similar to reports from other countries, this finding suggests that the risk for serious disease and death from COVID-19 is higher in older age groups. Similarly, the reported deaths among the south Florida shelter residents were greater than 50 years of age.

According to the American Public Health Association's (APHA) American Health Rankings: United Health Foundation [34], there has been increases in the numbers of individuals diagnosed with hypertension by a healthcare professional, from 33.5% in 2017 to 34.6% in 2018 and 2019; based on the prevalence of HTN [12,34]. In addition, complications of uncontrolled HTN include Acute Myocardial Infarction (AMI), Heart Failure (HF), stroke, retinopathy, and Chronic Kidney Disease (CKD) [35]. Any CVD such as HTN, Coronary Artery Disease (CAD) or stroke, increases the risk for an acute myocardial infarction (AMI) (fatal or non-fatal) 5 to 7 times. About one-third of AMIs are fatal; 50% of AMIs and 70% of cardiac deaths occur in individuals with prior manifestations of CVD such as seen in the two COVID-19 cases presented [35-36]. There is a clear relationship between CVD and DM with at least 68% of adults 65 and older with diabetes die from some form of CVD; and adults with DM have a two- to four-fold likelihood of dying from heart disease compared to adults without DM [36].

Disease Prevalence among homeless shelters: There is also a continued prevalence of risk factors in men with CAD (LDL-C >160 mg/dL and HDL-C < 35mg/dL). According to Gheisari et al.,[37] the role of gender in the distribution of risk factors in ischemic heart disease involving 1012 patients, 698 females (69%) and 314 males (31%), showed that males (19.1%) participating in this study, had significantly higher Ischemic Heart Disease (IHD) when compared to women (14.2%) [37]. Reports on the prevalence of COVID-19 infection among residents in large homeless shelters in Boson, Massachusetts, San Francisco, California, Seattle, Washington, Atlanta, Georgia, and Rhode Island identified characteristics associated with higher risk for transmission of COVID-19, the challenges of congregant living and maintaining adequate hygiene among residents, and results of reverse transcription-polymerase chain reaction testing at commercial and public health laboratories for SARS-CoV-2 [16,19-20].

According to Mosites et al., [20] 1,192 residents and 313 staff members were tested in 19 homeless shelters in four states, Massachusetts, California, Washington and Georgia, findings showed a low prevalence of infections in Atlanta and Seattle. However, when testing followed clusters identified through contact tracing, there were higher positivity rates among residents and staff members. In Baggett, et al. [16] researchers in Boston evaluated 408 shelter residents for symptoms of COVID-19 and conducted SARS-COV-2 PCR testing on all participants. The mean age of the Boston residents was 51.6 years; with men representing 71.6% of participants. The reported symptoms include fever (10%), cough (81%), shortness of breath (0.7%), diarrhea 1.2%, and other symptoms such as runny nose or sinus congestion (1.2%). There were 147 positive test results for SARS-COV-2, and males accounted for 84.4% of all positive cases [16]. The last study was conducted in Rhode Island by Karb, et al. [19]. The researchers tested 299 shelter residents and found that thirty-five (11.7%) were positive for SARS-COV-2. The five shelters involved in the study had a prevalence rate of 35% and was seen mostly among persons living in or around densely populated areas and in shelters providing minimal physical distancing [19].

CONCLUSION

Patients with cardiovascular comorbidity and COVID-19 are more likely to develop cardiac complications as seen in both deceased patients at our shelter, reported by the CDC [10] and presented by Chen et. al [21]. in their retrospective study showing that "regardless of history of cardiovascular disease, acute cardiac injury and heart failure were more common in deceased patients." Homelessness increases the prevalence of SARS-CoV-2 transmission, but varies among shelter character based upon agency policies. Early detection of SARS CoV-2 is essential among homeless populations to identify clusters, decrease viral transmission, increase early treatment and access to health care services, and to protect staff members and workers from exposure. Efforts to prevent the spread of COVID-19 in homeless shelters should include proper physical spacing in dormitory rooms, positioning the heads of beds away from others, providing approved hand sanitizers in easily accessible areas, providing face coverings, conducting RT-PCR testing, initiating quarantine measures for residents testing positive or SARS-Cov-2, and educating residents on the signs and symptoms of COVID-19, so that early detection and treatment can help decrease coronavirus related morbidity and mortality among homeless persons.

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