Characteristics of Emergency Department Patients With COVID-19 at a Single Site in Northern California: Clinical Observations and Public Health Implications

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In December 2019, a novel coronavirus disease (COVID-19) emerged in Wuhan, China, and spread globally, resulting in the first World Health Organization (WHO)-classified pandemic in over a decade.[1] As of April 2020, the United States has the most confirmed COVID-19 cases worldwide, but public health interventions and testing availability have varied across the country.[2]

Santa Clara County, California, has a population density of approximately 1,400 people per square mile and a high median household income ($116,178/year) and is part of the San Francisco Bay Area.[3] It was one of the first counties where COVID-19 was detected in the United States, with its first case (on January 31, 2020) being the seventh case nationwide.[4] The San Francisco Bay Area was also the first region in the United States to implement "shelter in place" orders on March 16, 2020, which consisted of widespread school and business closures and social distancing measures including prohibition of all nonessential travel and gatherings.[4]

The objective of this study was to describe the demographics, clinical characteristics, and outcomes of emergency department (ED) patients who tested positive for COVID-19 at a medical center in Santa Clara County with the aim of identifying clinical patterns and assessing possible effects of local public health measures.

This was an observational, cross-sectional study of ED patients with a laboratory-confirmed diagnosis of COVID-19 at a single academic hospital (Stanford Health Care). Our ED is a tertiary care, Level I trauma center that treated approximately 56,000 adults and 23,000 children in 2019. The hospital has 86 intensive care unit (ICU) beds.

A novel polymerase chain reaction (PCR) laboratory test to diagnose COVID-19 was developed at the Stanford Clinical Virology Laboratory and approved for clinical use by the Food and Drug Administration (FDA). It utilizes a nasopharyngeal swab specimen that is collected by a health care provider, preserved in viral transport medium, and tested via reverse-transcriptase–PCR (RT-PCR). The test screens for the presence of RNA encoding an envelope protein of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative virus of COVID-19, and is followed by a confirmatory test for the SARS-CoV-2 RNA polymerase.[5]

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The eligible population were patients who met ED screening criteria for COVID-19, including those with influenza-like symptoms (such as fever, sore throat, or cough), significant respiratory symptoms (such as shortness of breath), and/or self-reported exposure risk to COVID-19. In our descriptive analysis, we included patients who tested positive for COVID-19 from the launch of our institutional PCR test on March 4, 2020, until March 23, 2020. This study was approved by the institutional review board.

An investigator obtained the list of ED patients with positive COVID-19 tests from electronic medical records. Two trained emergency physicians performed chart reviews to extract the variables of interest and entered data into case report forms on a secure database. We collected: 1) patient variables including demographics, presenting symptoms, past medical history, and medications; 2) ED variables such as time to specimen collection, time to test results, and disposition; and 3) laboratory, radiologic tests, and clinical outcomes. Twenty percent of records were independently reviewed by a second physician.

We used frequency rates and percentages to report categorical variables, and median and interquartile range (IQR) values to report continuous variables. All statistical analysis was performed using SAS Enterprise Guide (version 8.2) and are descriptive in nature.

Among 1,468 ED patients who were tested for COVID-19 from March 4 to March 23, 2020, we identified 100 (6.8%) with positive results. The median time from test collection to result was 26 hours (IQR = 21–35 hours). There were 96 adults and four children, with an overall median age of 45 years and a range from 6 months to 91 years. There were 44 (44%) female patients and 42 (42%) patients were white (Table 1).

The most common presenting symptom was cough (87%) followed by objective or subjective fever (71%) and shortness of breath (38%). Eighteen patients (18%) were categorized as immunocompromised, which included those with diabetes, chronic kidney disease, or cancer or taking immunosuppressant medications (Table 1). Only 31 (31%) patients denied any known personal or travel exposure; all 69 others (69%) reported likely or confirmed exposure to COVID-19 through sick contacts (51%), travel (11%), or workplace exposure (7%). There were 16 (16%) health care workers.

Chest x-ray was obtained in 61 (61%) patients. Of those, the majority had an abnormal finding (33, 54%) including 24 (39%) with a radiology interpretation of pneumonia. Four patients with abnormal chest x-ray also underwent noncontrast chest CT, which all showed bilateral ground-glass opacities. Of the 50 (50%) patients who underwent laboratory testing, the majority (27, 54%) were found to have a low absolute lymphocyte count. The presence of lymphopenia was higher (18, 75%) in those admitted (Table 1). Most patients (91, 91%) had one or more other respiratory panels sent; 22 were tested for influenza A/B and respiratory syncytial virus (RSV), while 69 were tested with a wider respiratory panel that includes influenza, RSV as well as parainfluenza 1–4, metapneumovirus, rhinovirus/enterovirus, adenovirus, *Chlamydia pneumoniae,* and *Mycoplasma pneumoniae.* Twelve (13%) patients who underwent other viral testing were found to be positive for a concomitant infection, the most common being rhinovirus/enterovirus and RSV.

Twenty-four patients (24%) were admitted to the hospital. Patients admitted to the hospital had a trend toward greater age (median [IQR] = 64 [44–74] years vs. 42 [31–59] years) and one or more comorbidities (94% vs. 58%) compared to those who were not admitted.

Thirteen (13%) patients required oxygen support; eight patients received only low-flow oxygen using nasal cannula, one required nonrebreather oxygenation, and four patients were intubated. Six patients were admitted to the ICU, with a median age of 65 years but a wide range from 36 to 82 years. Two intubated ICU patients eventually underwent tracheostomy due to difficulty weaning from ventilatory support. Admitted patients were treated with antibiotics with the most common being azithromycin (18, 75%); an antiviral trial drug, remdesivir (11, 46%); and/or hydroxychloroquine (4, 17%). The median (IQR) length of stay was 9 (3–12) days, including one patient who remains admitted but is no longer critically ill. One patient (1%), aged 82 years, died due to COVID-19 in this cohort to date.

Due to the availability of an institutional PCR test early in our course of this outbreak, we had the unique opportunity to perform relatively broad COVID-19 testing through the ED. This allowed us to identify COVID-19 prevalence among patients of a wide range of clinical severity, with the majority of patients having mild symptoms that could be managed at home. This disease severity pattern is similar to data from China where 81% of patients were categorized as having mild disease.[6] Similar to prior reports, the

Table 1
Demographics and Clinical Characteristics of Patients Testing Positive for COVID-19

	Overall (n = 100)	Admitted (n = 24)	Not Admitted (n = 76)
Age (years)	45 [32–65]	64 [44–74]	42 [31–59]
Female	44 (44)	11 (46)	33 (43)
Race and ethnicity			
White	43 (43)	7 (29)	35 (46)
Hispanic/Latino	23 (23)	6 (25)	17 (22)
Asian	16 (16)	4 (17)	12 (16)
Other	13 (13)	5 (21)	8 (11)
Pacific Islander	4 (4)	1 (4)	3 (4)
Black or African American	1 (1)	1 (4)	0 (0)
Health care providers	16 (16)	3 (13)	13 (17)
Comorbidities			
Obesity (BMI > 30)	22 (22)	9 (38)	13 (17)
Hypertension	19 (19)	8 (33)	11 (14)
Immunocompromised	18 (18)	7 (29)	11 (14)
Diabetes	10 (10)	3 (13)	7 (9)
Chronic kidney disease	6 (6)	4 (17)	2 (3)
Immunosuppressant medication	4 (4)	1 (4)	3 (4)
Cancer	3 (3)	1 (4)	2 (3)
Hyperlipidemia	14 (14)	3 (13)	11 (14)
Asthma	10 (10)	3 (13)	7 (9)
COPD	1 (1)	1 (4)	0 (0)
Smoker	2 (2)	2 (8)	0 (0)
Symptoms			
Cough	87 (87)	21 (88)	66 (87)
Fever/chills	71 (71)	21 (88)	50 (66)
Shortness of breath	38 (38)	17 (71)	21 (28)
Fatigue/weakness	21 (21)	11 (46)	10 (13)
Myalgia	21 (21)	2 (8)	19 (25)
Sore throat	21 (21)	3 (13)	18 (24)
Chest pain	19 (19)	4 (17)	15 (20)
Rhinorrhea/congestion	16 (16)	3 (13)	13 (17)
Headaches	15 (15)	4 (17)	11 (14)
Nausea/vomiting	15 (15)	6 (25)	9 (12)
Diarrhea	10 (10)	5 (21)	5 (7)
Decreased taste/smell	3 (3)	2 (8)	1 (1)
Onset of symptoms	61 (61)	23 (96)	38 (50)
0 to < 7 days	72 (72)	15 (63)	57 (75)
7 to < 14 days	19 (19)	7 (29)	12 (16)
14 days or more	7 (7)	1 (4)	6 (8)
Chest x-rays (% of total chest x-rays)	50 (50)	24 (100)	26 (34)
Normal	28 (46)	2 (9)	26 (68)
Pneumonia	24 (39)	16 (70)	8 (21)
Other abnormalities	9 (15)	5 (22)	4 (11)
Laboratory tests [reference range] (% of total labs)			
White blood cell count, $\times 10^9$/L [4–11]			
Low	7 (14)	3 (13)	4 (15)
High	5 (10)	2 (8)	3 (12)
Neutrophils, absolute, $\times 10^9$/L [1.7–6.7]			
Low	1 (2)	0 (0)	1 (4)

(Continued)

Table 1. (continued)

	Overall (n = 100)	Admitted (n = 24)	Not Admitted (n = 76)
High	8 (16)	4 (17)	4 (15)
Lymphocytes, absolute, $\times 10^9$/L [1.0–3.0]			
Low	27 (54)	18 (75)	9 (35)
High	3 (6)	0 (0)	3 (12)
Hemoglobin, g/dL [11.7–17.7]			
Low	26 (52)	14 (58)	12 (46)
Platelet count, $\times 10^9$/L [150–400]			
Low	10 (20)	7 (29)	3 (12)
High	1 (2)	0 (0)	1 (4)

Data are reported as median (IQR) or n (%).
BMI = body mass index; COPD = chronic obstructive pulmonary disease; IQR = interquartile range.

median age of patients who required inpatient or ICU admission was higher than those not admitted.[7] However, there were instances of younger adult patients (aged 36 and 42) who required critical care.

The 1% mortality rate in our cohort is lower than that reported in the United States as a whole (5.3%) and that of other endemic nations (5.5% in China, 13.2% in Italy).[2] This reflects patterns of relatively low disease prevalence noted in the San Francisco Bay Area compared to other regions of the United States such as the New York City, New Orleans, or Detroit metro areas.[2] Despite the early emergence of COVID-19 in our region, Santa Clara County has had a total of 1,870 cases and 73 deaths as of April 19, 2020, with the highest incidence of new cases occurring during the week of March 22, 2020.[4] Our period of data collection overlapped with the time of peak local case incidence, and the burden of disease has remained within the capacity our county and institutional resources. Although multiple factors including differences in demographics and infrastructure likely played a role, early "shelter in place" policies and wider testing availability likely contributed to these findings, as suggested by the reduction in incidence of new COVID-19 cases noted in Wuhan, China, after the implementation of similar public health measures.[8]

Another finding that has been recently reported is the evidence of coinfection with SARS-CoV-2 and other respiratory pathogens. [9] We found several viral coinfections among patients testing positive for COVID-19, which suggests that when emergency physicians evaluate patients for possible viral illness, a positive test for another pathogen should not exclude the workup for COVID-19 in the correct clinical context.

A limitation of this study is that it is from a single center with a limited sample size and therefore the results may not be widely generalizable. The majority of ED patients who tested positive for COVID-19 presented with cough or fever and had a benign clinical course, with older patients more likely to require admission. Critical care utilization and mortality rate was not overwhelming in our county or institution, and ongoing efforts to build an ED COVID-19 database may better determine the causal inferences of timely public health interventions.

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