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Characteristics and Outcomes of COVID-19 Infection from an Urban Ambulatory COVID-19 Clinic—Guidance for Outpatient Clinicians in Triaging Patients

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Abstract

Background: Coronavirus infection (COVID) presents with flu-like symptoms and can cause serious complications. Here, we discuss the presentation and outcomes of COVID in an ambulatory setting along with distribution of positive cases amongst healthcare workers (HCWs). **Method:** Patients who visited the COVID clinic between 03/11/2020 and 06/14/2020 were tested based on the CDC guidelines at the time using PCR-detection methods. Medical records were reviewed and captured on a RedCap database. Statistical analysis was performed using both univariate and bivariate analysis using Fischer's exact test with 2-sided *P* values. **Results:** Of the 2471 evaluated patients, 846 (34.2%) tested positive for COVID. Mean age of positivity was 43.4 years (SD ± 15.4), 60.1% were female and 49% were Black. 58.7% of people tested had a known exposure, and amongst those with exposure, 57.3% tested positive. Ninety-four patients were hospitalized (11.1%), of which 22 patients (23.4%) required ICU admission and 10 patients died. The overall death rate of patients presenting to clinic was 0.4%, or 1.2% amongst positive patients. Median length of hospital stay was 6 days (range 1-51). Symptoms significantly associated with COVID included: anosmia, fever, change in taste, anorexia, myalgias, cough, chills, and fatigue. Increased risk of COVID occurred with diabetes, whereas individuals with lung disease or malignancy were not associated with increased risk of COVID. Amongst COVID positive HCWs, the majority were registered nurses (23.4%), most working in general medicine (39.8%) followed by critical care units (14.3%). **Discussion/Conclusion:** Blacks and females had the highest infection rates. There was a broad range in presentation from those who are very ill and require hospitalization and those who remain ambulatory. The above data could assist health care professionals perform a targeted review of systems and co-morbidities, allowing for appropriate patient triage.

Keywords

healthcare associated infection, COVID-19, ambulatory clinic, presenting symptoms, high risk population

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Background

In late 2019, infection with a novel betacoronavirus, subsequently named SARS-CoV-2 (which causes COVID-19 infection or "COVID"), was initially reported in Wuhan, China. Since then, there has been rapid spread of the virus, leading to a global pandemic. As of April 15, 2021 the United States had over 31.4 million cases and over 564 000 deaths.[1] A major challenge to containing the spread of COVID-19 is that pre-symptomatic/asymptomatic people

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are infectious.[2] Recent reports suggest that persons may be infectious at least 1 to 3 days prior to symptom onset and that up to 40% to 50% of cases may be attributable to transmission from asymptomatic people.[3]

COVID infection is known to cause a wide range of presentations, from asymptomatic to severe acute respiratory distress syndrome and multiorgan dysfunction.[4] The most common features of infection are known to be fever, cough and shortness of breath. However, there is a wide range of presentations for COVID infection beyond these well described symptoms. The primary aim of this study was to investigate and characterize mild to moderate COVID infection and risk factors associated with infection and outcomes. The secondary aim was to determine the risk of infection in healthcare workers amongst various departments and occupations. We describe the clinical presentations and outcomes of patients that presented to a dedicated COVID clinic in Washington, DC.[5]

Methods

This study is a retrospective, single center, observational study involving a cohort of patients who were evaluated in the dedicated COVID clinic at a large, urban hospital in Washington, DC from March 11, 2020, through June 14, 2020 (when the clinic closed). We report data from 2821 patients that were evaluated in the COVID clinic. Patients from the community and hospital associates were seen in the clinic. At the time they were pre-screened for symptoms, however, some patients were seen if they had COVID-19 exposure (eg from group homes, household contacts). Patients were then screened, examined and tested by nurse practitioners, physician assistants and physicians in the clinic with decisions for testing made according to CDC guidelines in place at the time of each encounter, most often only if the patient was symptomatic. Testing was conducted using PCR-based nasal swabs, both nasopharyngeal and mid-turbinate. Positive SARS-COV2 test results were used as a surrogate for COVID infection. Samples were processed by the hospital clinical lab if the patient was an hospital associate or by a large commercial lab if they were not an employee. A dedicated ambulatory team was assigned to calling each patient, providing test results, counseling regarding transmission and providing information on need for quarantine or isolation.

Medical students and internal medicine residents collected the following data from patients' medical records: demographics, occupation (if healthcare worker), known exposure to COVID positive contacts, comorbidities, presenting symptoms, current medications, hospitalizations, ICU admission and death. Study data was collected and managed using REDCap electronic data capture tools hosted by MedStar Health Research Institute.[6] All patient identifiers were removed once they were entered into REDCap. The authors audited an appropriate proportion of the total abstracted data for validation and reproducibility. This study was approved by the Institutional Review Board of MedStar Health Research Institute. We also reviewed the CRISP HIE (Chesapeake Regional Information System for our Patients, Health Information Exchange)[7] that allows for patient clinical information to be shared across distinct institutional health systems to check for readmissions and/or deaths if the patient was admitted to another hospital.

Symptoms were defined as mild to moderate if the patients were sent home with symptomatic management and isolation after evaluation in the COVID clinic. Severe disease was defined as patients requiring hospitalization. Statistical analyses were performed using univariate analysis using Fischer's exact test for categorical variables and Student's *t*-test for normally distributed continuous variables with 2-sided P values. Bivariate analysis was performed to determine association between medical conditions, COVID infection and outcomes. Statistical significance was defined as a P value of <0.05. Statistical analysis was performed using SPSS and Graftpad PRISM software.

Results

A total of 2821 patients presented to the COVID clinic, of which 2471 (87.9%) were tested for SARS-CoV2. Approximately one-third of patients tested were positive for COVID (n=846 or 34.2%). The demographics of the patients are demonstrated in Table 1. The mean age of patients with COVID was 43.4 with SD ± 15.4 years. A total of 1486 positive patients (60.1%) were female and 981 (39.7%) were male; more women tested positive ($P < .001$). The majority of patients who presented to the clinic were Black/African American [n=1403 (49.7%)] of which 400 (28.5%) were found to be positive; 257 (13.0%) were Hispanic, of whom 183 (71.2%) were positive; more Hispanics than Blacks tested positive ($P < .001$). A history of known exposure to any confirmed case of COVID (not limited to only hospital exposure) was documented in 1650 (58.7%) of all patients, of which 485 (33.3%) were positive for COVID-19.

A total of 1332 (47.2%) patients were healthcare workers, and 321 (24.1%) were found to be COVID positive; HCWs were less likely to test positive than non-HCWs (44.8%). The number of registered nurses presenting to clinic were n=645 (26.1%) and physicians were n=309 (12.5%). Amongst healthcare workers who were positive, the majority were registered nurses n=75 (23.4%) followed by medical assistants/personal care technicians n=34 (10.6%), then physicians n=22 (6.9%) and food services employees n=22 (6.9%). The highest number of cases were observed in healthcare workers working in general medicine n=314 (39.8%) followed by critical care units n=46 (14.3%). See Figures 1 and 2 for a detailed distribution.

Table 1. Demographic Data.

Demographic data	All patients (n = 2821, % of all patients)	Patients tested (n = 2471)	COVID-19 positive patients (n = 846, % out of all tested)	COVID-19 negative patients (n = 1625, % out of all tested)	*P*-value
Age, years					
Mean	43.4		43.2	43.5	
±std. deviation (SD)	15.4		15.1	15.5	
Gender (%)					<.001
Female	1661 (58.9)	1486	440 (29.6)	1046 (70.4)	<.001
Male	1151 (40.1)	981	404 (41.2)	577 (58.8)	<.001
Other/not specified	9 (0.3)	4	2 (50.0)	2 (50.0)	.61
Race/ethnicity (%)					
Black/African American	1403 (49.7)	1197	400 (33.4)	797 (66.4)	.42
White/Caucasian	366 (13.0)	345	69 (20.0)	276 (80.0)	<.001
Hispanic	257 (9.1)	250	183 (73.2)	67 (26.8)	<.001
Asian	82 (2.9)	80	11 (13.7)	69 (86.3)	<.001
Native American	10 (0.4)	10	4 (40.0)	6 (60.0)	.66
Other	703 (24.9)	589	179 (30.4)	410 (69.6)	.41
Exposure status (%)					
Exposed	1650 (58.7)	1455	485 (57.3)	970 (59.7)	<.001
Not exposed	593 (21.1)	518	207 (24.5)	311 (19.1)	.007
Unknown	53 (4.7)	116	47 (5.6)	69 (4.2)	.16
Not specified	516 (15.5)	382	107 (12.6)	275 (16.9)	.006
Healthcare worker (%)					
Yes	1332 (47.2)	1298	321 (37.9)	977 (60.1)	<.001
No	1489 (52.3)	1173	525 (62.1)	648 (39.9)	<.001
COVID-19 testing offered (%)					
Yes	2471 (87.9)				
No	341 (12.1)				
COVID-19 test result (%)					
Positive	846 (34.2)				
Negative	1625 (65.8)				

Amongst all patients who tested positive, 101 patients (11.1%) required hospitalization after being evaluated in the ambulatory clinic. The median number of days from testing to hospitalization was 2 days (range 0-25), with a median length of hospital stay of 6 days (range 1-51). Out of the 101 patients who were hospitalized, 22 (23.4%) required ICU admission and 10 died (11%). See Table 2. The overall mortality rate of patients presenting to COVID clinic was 0.4% and amongst all who tested positive was 1.2%.

When compared to patients with negative COVID tests, the symptoms significantly associated with COVID positivity included (Figure 3): anosmia (OR = 3.85 CI [2.89-5.11]), subjective fever (OR = 3.61 CI [3.03-4.3]), change in taste (OR = 3.18 CI [2.46-4.1]), anorexia (OR = 3.11 CI [2.17-4.49]), objective fever (OR = 2.41 CI [1.95-2.97]), myalgias (OR = 2.3 CI [1.93-2.74]), cough (OR = 2.15 CI [1.79-2.57]), chills (OR = 1.77 CI [1.48-2.12]), fatigue/malasie (OR = 1.69 CI [1.21-2.03]) and headache (OR = 1.21 CI [1.01-1.46]). Sore throat was associated with being COVID negative (OR = 0.68 CI [0.56-0.81]). The following symptoms were not statistically significant as presenting symptoms of COVID infection: dizziness (OR = 1.4 CI [0.9-2.17]), nausea (OR = 1.15 CI [0.86-1.53]), diarrhea (OR = 1.14 CI [0.88-1.47]), rhinorrhea (OR = 1.07 CI [0.82-1.4]), vomiting (OR = 0.97 CI [0.64-1.51]), chest pain (OR = 0.87 CI [0.67-1.14]) and abdominal pain (OR = 0.74 CI [0.46-1.17]).

No significant differences were noted in the presenting vital signs for positive and negative patients: COVID positive patients had the following mean vital signs: temperature 37.1°C, blood pressure 131/82 mmHg, heart rate 86/min, respiratory rate 17/min, SpO2 98%; whereas COVID negative patients had the following mean vital signs: temperature 37.1 C, blood pressure 132/83 mmHg, heart rate 84.4/min, respiratory rate 17/min and SpO2 98%.

Individuals with diabetes were more likely to have COVID infection [OR 1.39, CI 1.09-1.77]; whereas individuals with malignancy, asthma, and other lung diseases were less likely

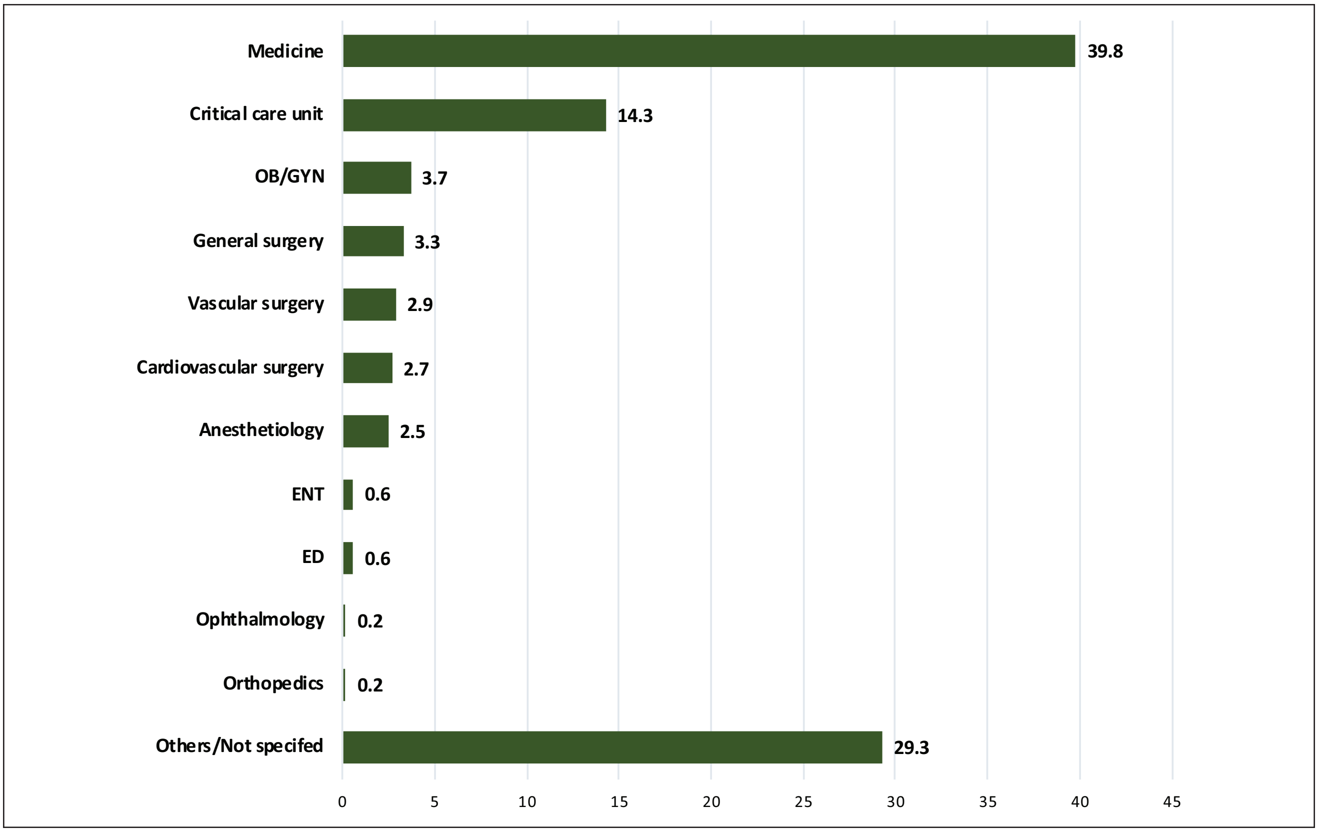

Figure 1. Distribution of healthcare workers who tested positive based on their department of work (in %).

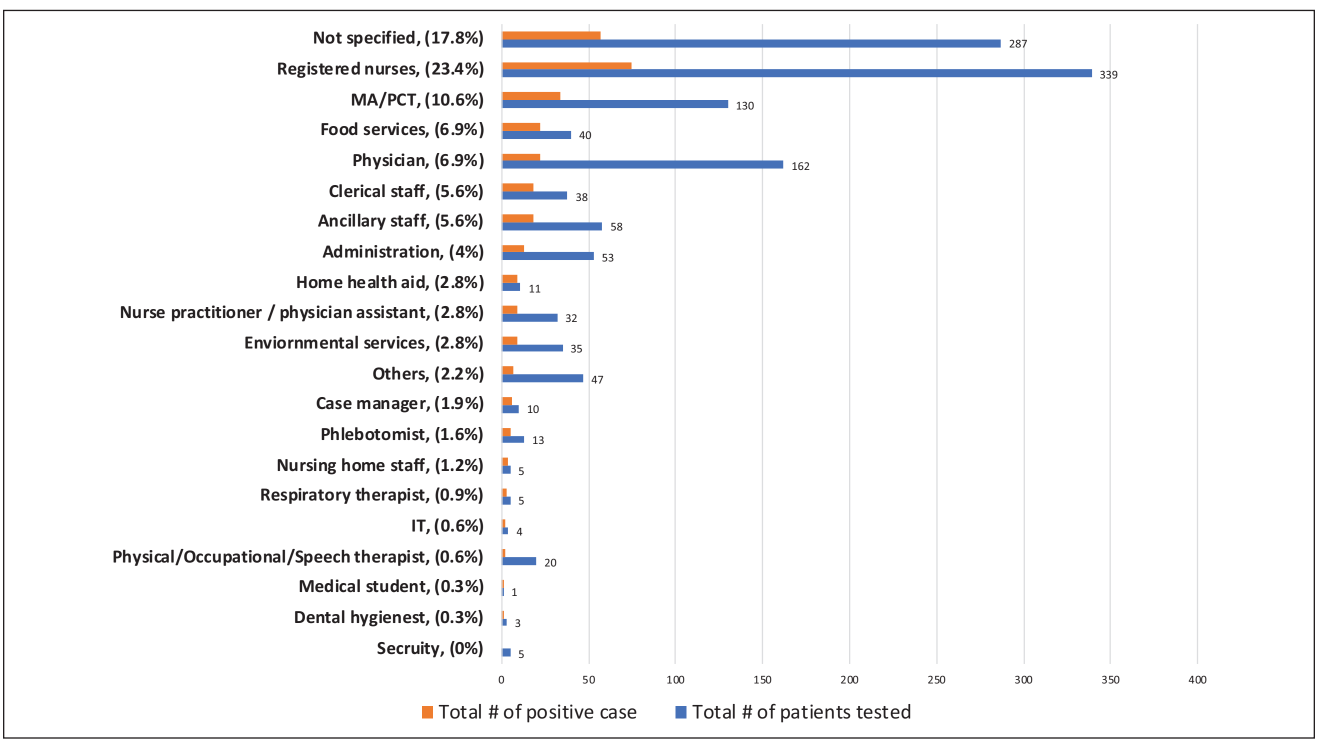

Figure 2. Distribution of healthcare workers who presented to the clinic (blue) and those who tested positive (red) based on their occupation.

Table 2. Description of COVID-19 Patients.

COVID-19 positive patients	n = 846	
Mild to moderate disease*	752	[88.9%]
Severe disease**	94	[11.1%]
Patients requiring non-ICU stay	72	[76.6%]
Patients requiring ICU stay	22	[23.4%]
COVID-19 patient with severe disease		
Length of hospital stay (in days)	Median	6
	Range	[1-51]
	Q25-Q75	5.75
Median number of days from initial presentation to hospitalization	Median	2
	Range	[0-25]
Mortality rate		
All COVID-19 positive patients	1.2%	
Severe disease	11.0%	

*Defined as individual who has signs and symptoms of COVID-19 and were treated at home with symptomatic treatment ± oxygen.
**Defined as patients requiring hospitalization for close monitoring and treatment.

to be COVID infected (see Figure 3 for odds ratios). Other co-morbidities such as hypertension, heart failure, chronic obstructive pulmonary disease (COPD), human immunodeficiency virus infection (HIV), end stage renal disease on hemodialysis, chronic kidney disease (CKD) not on hemodialysis and immunocompromized patients did not have statistically significant associations with COVID infection. No significant association was observed between medication use and COVID infection except for patients on insulin [1.52 (1.05-2.22)]; those with proton pump inhibitor use were less likely to be associated with COVID [0.65 (0.47-0.9)].

Using bivariable analysis, we found that COVID infection in patients with any lung disease (excluding asthma), as well as asthma alone, was associated with cough, ED referral and hospitalization, but did not have a significant association with sore throat or shortness of breath. See Table 3. Objective fever (OR 3.34, CI 1.14–10.89) was significantly associated with COVID infection in patients with malignancy, and all patients with malignancy that presented with anorexia had COVID infection. Patients with malignancy also had a statistically significant association with hospitalization (OR 49.50, $P < .001$). Diabetics were more likely to be infected and hospitalized (OR 16.22, $P < .001$), whereas diabetes with insulin use had no significant association with COVID-19 infection (OR 1.22, $P = .47$). Patients that presented to the clinic with lung disease and diabetes were more likely to be referred to the ED.

Discussion

This is a descriptive study on the epidemiology and clinical presentation of COVID in an ambulatory setting, and includes data from 2821 patients. We have compared the clinical presentation of COVID infection with other patients that had similar presentations but were PCR negative, and thus considered as not infected. Primary care-level screening, triaging, referral, and emergency care of COVID-19 patients in the backdrop of the current pandemic are all necessary aspects of care. Hence, we believe that this data will help providers globally with triaging patients using predictive symptoms and comorbidities to diagnose COVID-19 early in the disease presentation.

Main Findings

Amongst all patients who were tested in the clinic, almost 1 in 3 patients were positive for SARS-CoV2, which represents a high infection rate. Of those infected, 88% of patients had mild to moderate disease and 11% of patients had severe disease requiring hospitalization with a median of 2 days from presentation to hospitalization. This suggests that most patients with severe disease are more likely to decompensate and become hospitalized within 2 days of presenting with symptoms and being tested (range 0-51 days). In those with severe disease, 23.4% required ICU admission at some point during their stay and had a median length of hospitalization of 6 days. The observed mortality rate was 11% in severe disease, however, overall mortality rate of all patients presenting to COVID clinic was 0.4% and amongst those who tested positive was 1.2%. The above data suggest that there is a broad gap in mortality of those who are very ill and require hospitalization to those who have mild to moderate infection and remain ambulatory. This will assist in conversations between patient and provider and will likely provide reassurance to those who are not admitted.

The majority of the patients who presented to the clinic and were positive for COVID-19 infection were Black and Hispanic, which is concordant with many other studies in different cities in the United States. We believe this was contributed by multiple factors including the population distribution in Washington, DC, socioeconomic status as well as co-morbidities which contributed to higher infection risk. Importantly, this highlights the racial disparities associated with COVID-19 infection.[8,9]

Comparison with Existing Literature

We observed that mild to moderate COVID infection presented with the following (in order of decreasing strength of association) see Figure 3: anosmia, subjective fever, change in taste, anorexia, objective fever, myalgias, cough, chills, fatigue/malaise and headache, and could be used as predictive symptoms for infection. The following symptoms did not help differentiate the disease: dizziness, headache, nausea, diarrhea, rhinorrhea, vomiting, shortness of breath, chest pain, abdominal pain, sore throat, and nasal congestion. Apparently, shortness of breath which has been highly

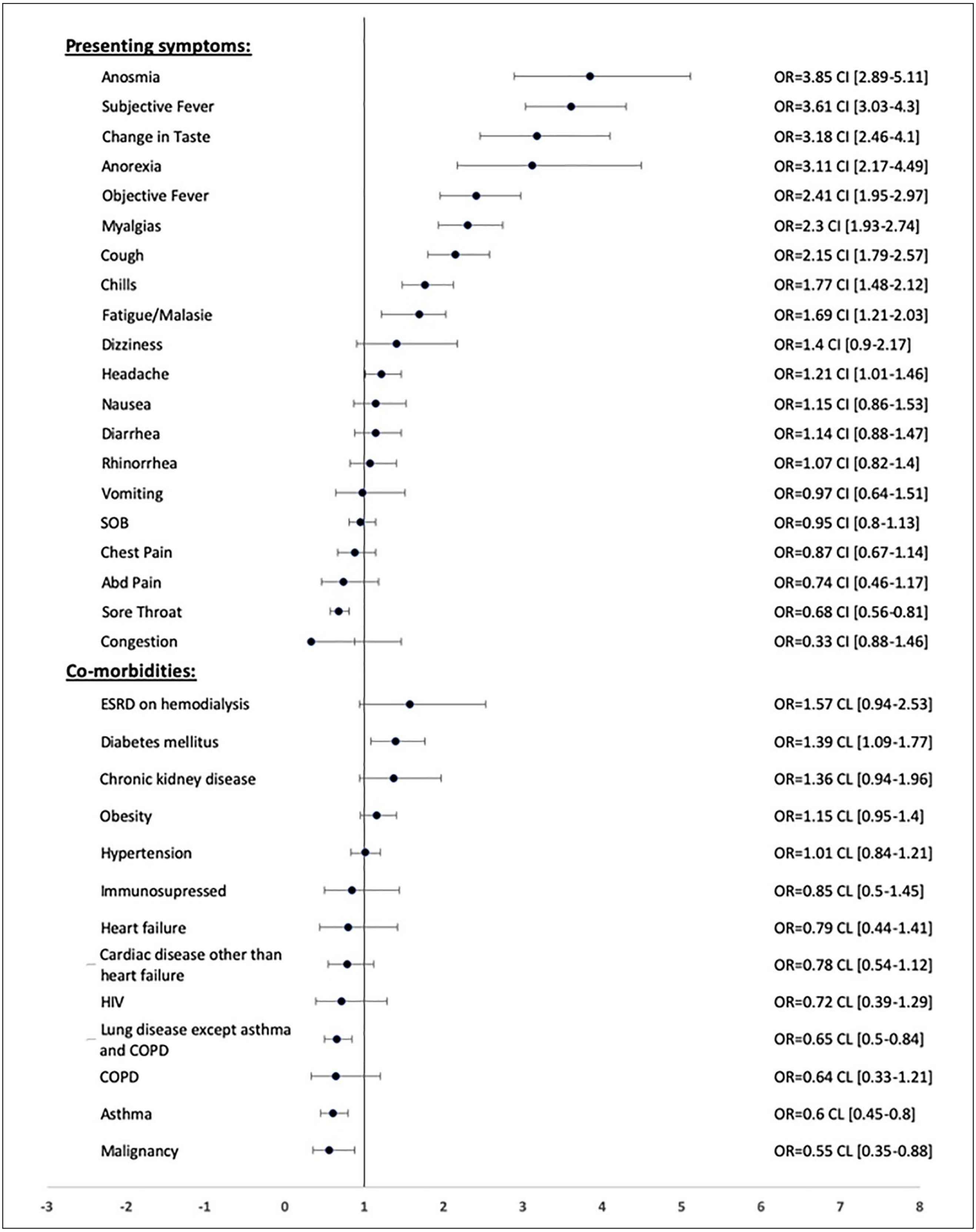

Figure 3. Association (in odds ratios) of presenting symptoms and co-morbidities in COVID-19 positive patients when compared to COVID-19 negative patients.

Table 3. Bivariate analysis showing the association of various diseases with COVID-19 infection.

Association of following with COVID-19 infection	Odds ratio	Confidence interval	*P*-value
Diabetes mellitus			
Use of insulin	1.22		.469
ED referral	2.94	1.23-6.84	.016
Hospitalization	16.22	5.08-51.54	<.001
Asthma			
Cough	2.64	1.27-5.33	.009
Sore throat	0.69		.341
Shortness of breath	0.89		.772
ED referral	4.67	1.54-13.34	.011
Hospitalization	40.26	6.82-436.4	<.001
Lung disease (other than asthma and COPD*)			
Cough	2.22	1.23-4.05	.009
Sore throat	0.62		.124
Shortness of breath	0.77		.317
ED referral	3.98	1.31-11.89	.013
Hospitalization	24.97	6.54-111	<.001
Malignancy			
Objective fever	3.35	1.14-10.89	.048
Anorexia	Infinity**		<.001
Subjective fever	2.56		.067
Chills	1.08		>.999
Fatigue/malaise	2.44		.148
Myalgias	1.48		.56
ED referral	3.75	0.81-16.75	.129
Hospitalization	49.5	6.47-547.2	<.001

*COPD was not included in the bivariate analysis as is was not statistically significant on univariate analysis.
**Everyone with malignancy that had anorexia had COVID and thus there was 100% correlation.

associated with COVID patients was not significantly associated with infection in this study—perhaps patients with more severe shortness of breath presented directly to the ED. Some of the clinical manifestations of COVID infection were consistent with studies on COVID patients in China except lack of association for shortness of breath.[10-12]

More than half of all patients (58.7%) who were evaluated at the COVID clinic had known exposure to a confirmed case of COVID (not limited to hospital COVID cases), and amongst exposed patients, one-third were COVID positive. Healthcare workers (HCWs) with known exposure had a positive rate of 23.5% (225/957). Infection rates observed in HCWs with known exposure were less when compared to non-HCWs with known exposure, which can be attributable to personal protective equipment and being more vigilant of infection control measures. Hence HCWs should continue to be vigilant about potential infection exposures and perhaps get tested early. Our finding are consistent with those in the review article by Bandyopadhyay et al,[13] where they found the most likely group to be affected by COVID-19 were RNs and general practicioners.

Nearly half of all patients (47.2%) who came to the clinic were healthcare workers, 57.3% (957) of whom had a known exposure to COVID confirmed cases. Amongst them, it was no surprise that the infection rate was highest amongst registered nurses, medical assistants and patient care technicians (PCT) as they spend most of the time with the patients in close proximity. Infection rates amongst physicians and food services employees was 6.9%; advanced practice clinicians was 2.8%. Clerical staff and ancillary staff constitute 5.6% of total positive HCWs each. All other departments, including administration and environmental services, accounted for less than 5% cases. Most of the workers who were infected with COVID worked in general medicine (non-intensive care unit or non-ICU) floors (39.8%) followed by those working in the ICU (14.3%). Perhaps this difference between the medicine floor and critical care units can be explained by negative pressure rooms in the ICU, and ICU patients already being known to be infected or were patients under investigation (PUI) where full COVID precautions were implemented, and thus had a low number of missed positive cases that could have caused transmission. Infection rates in all surgical branches were less than 4%, which is most likely secondary to the cancellation of elective procedures during the first surge of pandemic and the redistribution of healthcare workers to medical services to care for patients.

Patients with diabetes were more likely to have infection when compared to patients with other co-morbidities who presented to the COVID clinic. Similarly, patients with cancer, asthma or any known lung disease were also less likely to be infected. This could possibly be explained by those patients being more vigilant about their health and respiratory symptoms leading to earlier COVID testing, and likely more social isolation. Hospitalizations were associated with comorbidies of malignancy, asthma, any lung disease and diabetes, and perhaps there was a lower threshold for admission by the ED. These patients should remain more vigilant and seek care earlier in their disease. The OpenSAFELY database shows that COVID-19 related deaths were associated with most of the co-morbidities, however the data was for hospitalized patient (severe disease).[14] Similar findings were reported by Deng et al[15] for COVID-19 related deaths in hospitalized patients. We have found no other study with similar data to ours in an ambulatory setting.

Limitations

A limitation of this study is that it is a single site study with a significant proportion of patients being healthcare workers and patients who were symptomatic being predominantly tested. This was inline with the CDC recommendations at the time and we cannot comment on asymptomatic infected patients. This may make the results less generalizable to the entire population. However, we believe that this would provide a good representation of the disease in other large urban medical centers in the United States, where there will usually be a large proportion of healthcare workers being tested. Another limitation of this study was that some cases had incomplete documentation of the exposure history, occupation and race/ethnicity. While exposure history and occupation depended on the healthcare provider for collection, race/ethnicity was usually captured by clerical front desk staff, and was limited by the race/ethnicity choices available in the electronic health record. Given that this was retrospective, we do not have morbidity or mortality follow-up data on the patients' who were not hospitalized. However the advantage of our study was that CRISP was reviewed to determine if hospitalization/mortality occurred outside of our hospital network.

Conclusion

Based on the above data, we recommend that patients presenting to clinic that are: female, over 45 years of age, have a known exposure to COVID, are healthcare workers, are diabetic or have renal disease are higher risk for worse outcomes and should be instructed to be more vigilant about their symptoms and be given early referrals for monoclonal antibodies or other available outpatient treatment: However, if the patient is hemodynically unstable or has severe respiratory symptoms then referral to the emergency department would be appropriate. Those with more risk factors have a higher likelihood of being COVID-19 positive. When patients present with following symptoms they should be presumed COVID-19 positive until otherwise disproven by testing: anosmia, subjective/objective fevers, change in taste, anorexia, myalgias, cough, chills and fatigue.

COVID has spread rapidly since it was first identified and has been shown to have a wide spectrum of severity. COVID infection was identified in almost 1 out of 3 patients who had a known exposure to COVID infection. The data from this study could assist outpatient health care professionals perform a targeted review of systems and co-morbidities, allowing for more appropriate patient triage. It can provide guidance for clinicians in determining patient need and eligibility for available therapies, such as monoclonal antibody infusions. This work will also help healthcare workers maintain their own health and safety, especially as RNs, MAs and PCTs working in general medicine and critical care units, which are at highest risk and need to be remain vigilant of PPE and standard precautions. Future studies should include derivation of risk prediction models, along with clinical decision support tools for clinicians and HCWs. This pandemic has had an impact on the world in a rapid, universal, and powerful way, exposing deficiencies in both the resiliency of healthcare systems and the dissemination of best practices during an evolving crisis.

Authors' contributions

Conception and design: JT, DF, DB. Administrative support: JT, DF, NO, NF. Collection and assembly of data: JT, DB, SF, KJ, RA, RN. Data analysis and interpretation: JT, DF, DB. Manuscript writing: All authors. Final approval of manuscript: All authors.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Dr. Dawn Fishbein has served on a Gilead Advisory Board regarding HCV. However, No external funding for this COVID research was received.

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Ethics Approval and Consent to Participate

Ethics approval was obtained from MedStar Institutional Review Board. No informed consent was needed as the data collection involved chart review and all patient identifier, if any collected, were removed.

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Availability of Data and Material

Data supporting our findings can be found through the corresponding author: Dweep Barbhaya (dweepbarbhaya@gmail.com).

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