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Seroprevalence of novel coronavirus SARS-CoV-2 at a community hospital emergency department and outpatient laboratory in northern Orange County, California.

Abstract

Introduction: The severe acute respiratory syndrome related coronavirus 2 (SARS-CoV-2) has infected more than 20-million people worldwide and the spread is most prevalent in the US, where California had accounted for over 240,000 cases in the initial five months of the pandemic. To estimate the number of infected persons in our community, we conducted a cross-sectional study to estimate seroprevalence of SARS-CoV-2 infection.

Methods: This cross-sectional study evaluated the presence of immunoglobulin G, antibody for SARS-CoV-2 during the time period of 07/15/2020 to 07/27/2020. Testing was done on serum samples from patients who had visited affiliated outpatient clinics or our emergency department. Additionally, we collected age, gender, ethnicity, race, and location of testing.

Results: Eight hundred sixty-five tests were included in the study. The outpatient clinics cohort accounted for 56% of results and emergency department (ED) contributed 44%. The positive percentage of SARS-CoV-2 test was 9.4% (95% CI: 0.08-0.12). The positivity rates of the outpatient (5.6%) and ED (14.2%) setting differed. The prevalence of SARS-CoV-2 IgG was greatest in those that identified as Hispanic/Latino, 18.1% versus 6.7% in other groups. Specifically compared to the non-Hispanic/Latino population the prevalence was significantly higher, with a relative risk of 2.73 (95% CI: 1.8-4.1), $p<0.0001$.

Conclusion: The low antibody positivity rate in the community indicates the need for a vaccine. The Hispanic/Latino patient population should be considered for increased education on preventing transmission and acquisition of COVID-19 as well as being considered as a priority for vaccination once a vaccine is available.

Introduction

The severe acute respiratory syndrome related coronavirus 2 (SARS-CoV-2) is the cause of the coronavirus disease 2019 (COVID-19) pandemic [1, 2]. The virus has caused more than 20 million infections worldwide, with global deaths nearing three-quarters of a million [3, 4]. Within the US, the number of cases exceeds five million, and within California cases exceeded 240,000 during the first 5 months of the pandemic [4]. The spread of COVID-19 infections has not distributed evenly throughout California, and the capacity for testing for COVID-19 has limited an accurate assessment of prevalence in the community. Thus, the true prevalence in each community is uncertainty and there also exists a need for additional health literacy, understanding, and knowledge regarding the disease prevalence in each community to optimally develop targeted strategies [5]. To this, the Centers for Disease Control and Prevention (CDC) recommends understanding the characteristics of the community and its population, health system, and public health capacity in order to implement appropriate mitigation strategies specific to that community [6].

Based on the US Census Bureau, Orange County is considered a mildly diverse population with the majority of the population identifying as White non-Hispanic (71%) or Asian non-Hispanic (21.7%). However, the percent of the population that identifies as Hispanic/Latino in origin is 34% [7]. Previous reports have shown that racial minorities such as African American and Hispanics are disproportionately affected by COVID-19 as an association has been observed with these groups and acquisition of SARS-CoV-2 infection [8-10]. Data from the CDC Morbidity and Mortality Weekly Report from February to June 2020 only included one county in California, which may not be representative of other counties within the state [8]. To estimate the actual number of infected persons in our community, we conducted a cross-sectional study during the height of the pandemic to estimate seroprevalence of SARS-CoV-2 infection.

Methods

The cross-sectional study was performed at a medium sized non-academic community hospital, St. Jude Medical Center, Fullerton, CA. We performed the immunoglobulin G, IgG, antibody testing for SARS-CoV-2 during the time period of July 15, 2020 to July 27, 2020. Testing was done on serum samples from patients who had visited an affiliated outpatient clinic or our emergency department. Serum samples are routinely stored for several days after being used for their intended laboratory purpose. These residual samples were used in our study to test for

SARS-CoV-2 IgG antibodies prior to them being destroyed. Patients who visited multiple outpatient clinics and the emergency department during this time period were only counted once with the most recent positive result carried forward into analysis. The diagnostic platform utilized in the study was the Abbott Architect, which provided anti-SARS-CoV-2 IgG results. In addition to the anti-SARS-CoV-2 IgG test results, we performed a retrospective chart review and collected age, gender, ethnicity, race, and location of testing. The estimate of this study was the prevalence of seropositivity of anti-SARS-CoV-2 IgG and its 95% confidence interval. General population and study population data were obtained through geographic information systems data supplier, Esri. The institutional review board at Providence/St. Joseph Health Systems approved this study.

Statistical Analysis

Descriptive statistics were used to summarize the patient characteristics. Discrete data were presented as frequencies and percentages. The Pearson's chi-square or Fisher's test was used to measure the association between dichotomous variables. All tests were two-tailed and a P-value of <0.05 was considered significant. The prevalence of COVID-19 in the population was measured as crude rates of positive tests without adjustments and weighted prevalence using the Orange County population in 2019. The percentages of IgG positive patients were presented with 95% confidence intervals (CI). Statistical analyses were carried out with SPSS version 26.0 (Chicago, IL, USA) and GraphPad Prism version 6.0 (San Diego, CA, USA).

Results

Nine hundred ninety-two antibody tests were performed. There were 127 test results that were unavailable due to missing patient data (n=59) or were repeat patients (n=68). The outpatient clinics cohort accounted for 56% (n=484) of the test results, with the remaining tests in the emergency department (ED), 44% (n=381). The positive percentage of SARS-CoV-2 test was 9.4% (95% CI: 0.08-0.12). The positivity rates of the outpatient and ED setting differed; with an ER positivity rate 14.2% (95% CI: 0.11-0.18) and outpatient positivity rate 5.6% (95% CI: 0.04-0.08). Distribution of testing based on race and ethnicity are listed in Table 1. The prevalence of a positive COVID-19 test was greatest in those that identified as Hispanic or Latino at 18.1%. The rates of positivity in non-Hispanic or Latino and in patients who declined to state race or data not available was 6.7% in each group. The rates of positivity of the Hispanic/Latino population compared to the non-Hispanic/Latino population was significantly

higher, with a relative risk of 2.73 (95% CI: 1.8-4.1), p<0.0001. Overall, the prevalence of positive anti-SARS-CoV-2 IgG results was higher in the Hispanic/Latino population than those identified as non-Hispanic/Latino and individuals who declined to state, 18.1% vs 13.4%, respectively. The distribution of the COVID-19 positive tests based on age is listed on Table 2. The group with the highest prevalence of positive tests was the 20 - 29-year-old group at 21.8% followed by the 40 - 49-year-old group with 21.7%. The rates of positive COVID-19 tests were more prevalent in patients under the age of 60 years of age (15%) compared to those over 60 years (5.4%), p<0.0001, who are greater risk of severe illness. The age-adjusted prevalence of positive SARS-CoV-2 IgG test was 5.98 cases per 100,000 based on the 2019 Orange County population.

Discussion

The global pandemic has highlighted the increasing need for accessible testing to limit the spread of SARS-CoV-2. Unidentified SARS-CoV-2 positive patients pose a risk of continued viral exposure and perpetuation of the pandemic. It has been estimated that as much as 86% of infections were undocumented with mild, limited, or asymptomatic [11, 12]. Our cross-sectional study, evaluated the current positivity rate of COVID-19 in the community of northern Orange County and contributes to the underlying need for additional testing. The current level of seropositivity in the community indicates that more testing is required to identify a broader proportion of patients who have not sought medical care or had mild/asymptomatic cases to determine if herd immunity is a possibility. Historically, immunity in 80% of the population is needed to provide a herd immunity effect [13]. An issue that arises with herd immunity is that distribution of immunity in the population may not be uniform. It is also still unknown how long immunity to COVID-19 will last after infection or vaccination. Despite this unknown, having a vaccine and vaccinating the population would be a prudent strategy to limiting the spread of COVID-19 and reducing the associated morbidity and mortality.

From our cohort of patients, being of Hispanic/Latino origin had almost a three-fold relative risk for COVID-19 than non-Hispanic/Latino White patients. The rates of positivity were disproportionately high in comparison to the demographics of the service area. The population of St. Jude Medical Center service area population consists of 45.8% that identifies as Hispanic/Latino in origin. These study results are consistent with the Morbidity and Mortality Weekly Report compiled by the CDC where the Hispanic/Latino had the highest rates of COVID-19 associated with workplace outbreaks [14]. According to the US Census Bureau, the population in

California consists of 39.4% Hispanic/Latino, but the percent of COVID-19 cases throughout California has disproportionately affected this group exceeding 60%, which is also consistent with our study results [15, 16]. In a Kaiser Family Foundation survey regarding knowledge, attitude and good practices to reduce COVID-19 risk, racial/ethnic minorities were more likely to report engaging in better practices to reduce their risk of COVID-19, but had lower knowledge regarding the disease [17]. And yet minorities are more likely to acquire the infection and risk of mortality [8]. This could potentially be a health literacy issue or possibly due to the rates at which minorities work in essential worker positions that puts them at risk for COVID-19. Tools to improve health literacy regarding how to prevent COVID-19 acquisition needs to improve in this population. Strategies for this patient population should include targeted education and strong emphasis within this group for future immunization with a COVID-19 vaccine.

This study has several limitations. The study was retrospective and cross-sectional in design and reflects the internal flaws associated. Additionally, it is descriptive and only able to determine COVID-19 seroprevalence and not the true incidence in the population, and was conducted at the height of the pandemic in California, after the first wave and during the second wave of increased COVID-19 infections in California. We did not exclude patients visiting the emergency department for COVID-19 symptoms/diagnosis. We concede that the emergency department would increase the chances of having COVID-19, although the residual blood samples tested had no known connection to COVID-19 at the time of testing. The study population and results may not be generalizable to other institutions or counties and selection bias is unavoidable. It should be noted that the study sample size was not large enough to precisely measure other racial/ethnic populations as the number of patients from non-Hispanic, non-White, and patients in the age groups of 10-19 and >90 years of age were low and underrepresented. Thus, we were unable to estimate seroprevalence in these groups. The prevalence of COVID-19 is only increasing which will likely change the age-related positivity incidence. Our institution used the Abbott Architech testing system, which is approved under the FDA Emergency Use Authorization (EUA) with limited clinical studies using this device in real world settings, however it has been found that the sensitivity and specificity at ≥14 days from onset of symptoms is 100% and at ≥7 days from onset the sensitivity is 88.0% and specificity, 99.6% [18]. Finally, the numbers from our study likely underestimate the true positivity rate due to the lack of sufficient tests in the US and reported asymptomatic carrier rates.

In conclusion, the low antibody positivity rate and risk of morbidity and mortality associated with SARS-CoV-2 indicates the need for a vaccine. The population at greatest risk in our community and likely California for COVID-19 are those that identify as Hispanic/Latino. This patient population should be considered for increased education on preventing transmission and acquisition of SARS-CoV-2 as well as being considered as a priority for vaccination once a vaccine is available.

Declarations

Funding: This research received no external funding.

Conflicts of interest/Competing interests: The authors declare no conflict of interest.

Ethics approval: This study was approved by the Providence St. Joseph Health System Investigational Review Board.

Consent to participate: Not applicable

Consent for publication: Not applicable

Table 1: Distribution of COVID-19 positive serology tests based on Race/Ethnicity

Ethnicity and Race	Female Positive COVID test (n)	Total # Female Tested (n)	Female Positive COVID test % (95% CI)	Male Positive COVID test (n)	Total # Male Tested (n)	Male Positive COVID test % (95% CI)	Combined Positive COVID test (n)	Combined Total # Tested (n)	Combined Positive COVID test % (95% CI)
Hispanic or Latino	17	116	14.7 (9.3% - 22.3%)	20	88	22.7 (15.2% - 32.6%)	37	204	18.1 (13.4% - 24%)
Asian	0	3	-	0	0	-	0	3	-
White	16	98	16.3 (10.2% - 25%)	18	81	22.2 (14.5% - 32.5%)	34	179	19 (13.9% - 25.4%)
Not available/decline to state	3	17	17.6 (5.4% - 41.8%)	2	7	28.6 (7.6% - 64.8%)	5	24	20.8 (8.8% - 40.9%)
Non-Hispanic or Latino	19	336	5.7 (3.6% - 8.7%)	22	280	7.9 (5.2% - 11.7%)	41	616	6.7 (4.9% - 8.9%)
American Indian or Alaska Native	0	1	-	0	1	-	0	2	-
Asian	3	60	5 (1.2% - 14.3%)	5	46	10.9 (4.3% - 23.5%)	8	106	7.6 (3.7% - 14.4%)
Black or African American	2	8	25 (6.3% - 59.9%)	1	8	12.5 (0.1% - 49.2%)	3	16	18.8 (5.8% - 43.8%)
Native Hawaiian or other Pacific Islander	0	0	-	0	1	-	0	1	-
White	14	254	5.5 (3.2% - 9.1%)	13	209	6.2 (3.6% - 10.4%)	27	463	5.8 (4% - 8.4%)
Not available/decline to state	0	13	-	3	15	20 (6.3% - 46%)	3	27	11.1 (3% - 28.9%)
Unknown/decline to state	3	26	11.5 (3.2% - 29.8%)	0	19	0	3	45	6.7 (1.6%- 18.5%)
Asian	0	1	-	0	3	-	0	4	-
Black or African American	0	1	-	0	0	-	0	1	-
White	2	17	11.8 (2% - 35.6%)	0	13	0	2	30	6.7 (0.8% - 22.4%)
Not available/decline to state	1	7	14.3 (0.5% - 53.4%)	0	3	0	1	10	10 (<0.01% - 42.6%)

Table 2: Distribution of COVID-19 positive serology tests based on age

Age	Female Positive COVID test (n)	Total # Female Tested (n)	Female Positive COVID test % (95% CI)	Male Positive COVID test (n)	Total # Male Tested (n)	Male Positive COVID test % (95% CI)	Combined Positive COVID test (n)	Combined Total # Tested (n)	Combined Positive COVID test % (95% CI)
10-19	1	6	16.7 (1.1% - 58.2%)	0	3	-	1	9	11.1 (<0.01% - 45.7%)
20-29	7	37	18.9 (9.2% - 34.5%)	5	18	27.8 (12.2% - 51.2%)	12	55	21.8 (12.8% - 34.5%)
30-39	5	49	10.2 (4% - 22.2%)	5	32	15.6 (6.4% - 32.2%)	10	81	12.4 (6.7% - 21.5%)
40-49	6	48	12.5 (5.5% - 25.1%)	12	35	34.3 (20.8% - 50.9%)	18	83	21.7 (14.1% - 31.8%)
50-59	8	71	11.3 (5.6% - 20.9%)	5	62	8.1 (3.1% - 17.9%)	13	133	9.8 (5.7% - 16.1%)
60-69	5	80	6.3 (2.4% - 14.2%)	9	79	11.4 (5.9% - 20.5%)	14	159	8.8 (5.2% - 14.3%)
70-79	3	88	3.4 (0.8% - 10%)	1	76	1.3 (<0.01% - 7.8%)	4	164	2.4 (0.07% - 6.3%)
80-89	2	81	2.5 (0.2% - 9.1%)	4	63	6.4 (2.1% - 15.7%)	6	144	4.2 (1.7% - 9%)
90-99	2	17	11.8 (2% - 35.6%)	1	18	5.6 (<0.01% - 27.7%)	3	35	8.6 (2.2% - 23.1%)
100-109	0	1	-	0	1	-	0	2	-

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