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E. Lisa Chung Date

Case-control study to evaluate risk factors associated with a positive RT-PCR for SARS-CoV-2 in a population tested at the Mexican Consulate of Atlanta, GA

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Bachelor of Science, Seattle Pacific University, 2013

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An abstract of

A thesis submitted to the Faculty of the
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Abstract

Case-control study to evaluate risk factors associated with a positive RT-PCR for SARS-CoV-2 in a population tested at the Mexican Consulate of Atlanta, GA

By E. Lisa Chung

Background: The COVID-19 pandemic in the United States exposed existing health inequities and health disparities among racial and ethnic minority groups. The Emory COVID-19 Outbreak Response Team (ORT), in partnership with the Mexican Consulate of Atlanta, provided voluntary COVID-19 testing opportunities to predominantly Hispanic/Latinx individuals as a part of disease surveillance efforts.

Methods: A matched case-control study was designed to evaluate the risk factors associated with having a positive SARS-CoV-2 RT-PCR result among the population who received a free diagnostic test at the Mexican Consulate of Atlanta between September 2020 and February 2021.

Results: This study included 37 cases and 74 controls after matching on age and the date of specimen collection. The median age of cases was 39.0 (IQR: 25.2-46.9) and controls was 39.1 (IQR: 24.5-46.8). Sex was evenly distributed; 49% of cases and 54% of controls were women. The majority of the study population self-identified as Hispanic/Latino (93%). Among cases, 30% were asymptomatic. After controlling for age, having a known exposure within the past 14 days (OR=2.98, 95% CI: 0.88, 10.15) and reporting two or more symptoms (OR=8.15, 95% CI: 1.74, 38.17) were associated with resulting a positive SARS-CoV-2 RT-PCR. Alternatively, this study found that working in essential industries such as healthcare environments, the food industry, or the airport was less likely to be associated with a positive COVID-19 test (OR = 0.153; 95% CI: 0.02, 1.05).

Conclusion: In this almost exclusively Hispanic/Latino testing population, we found that a known exposure and two or more symptoms was associated with testing positive during the fall and winter of 2020-2021. Asymptomatic cases were less common than estimates that are closer to 40%. Essential worker status was protective, likely reflecting that this far into the pandemic, the risk differential by work status has been mitigated. While this population had fewer asymptomatic cases, easily accessible testing remains a critical public health effort to curb the COVID-19 pandemic.

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Introduction

The COVID-19 pandemic in the United States exposed existing health inequities and health disparities among racial and ethnic minority groups (1–3). Since the first laboratory confirmed case of COVID-19 in Washington State in 2020, over 32 million cases and 570,000 deaths have occurred in the United States (US) alone (4). In the US, 18.45% of the United States population identifies as Hispanic/Latinx, yet they account for 29.1% of the total confirmed COVID-19 cases with available race and ethnicity data in the US as of May 2, 2021 (4). Comparatively, non-Hispanic whites constitute 60.11% of the US population and 50% of the total confirmed COVID-19 cases. The difference in burden of disease is striking and is even more notable when comparing mortality rates (4–6).

In the early months of the pandemic, predominantly older persons in skilled nursing facilities or closed cohorts on cruise ships were the initial clusters of the outbreak across the United States as many states enforced shelter in place ordinance and remote learning for students (7–9). The beginning of the pandemic in Georgia unfolded in a similar pattern as the rest of the US. Following the initial clusters of outbreaks, the picture of the at-risk population in Georgia shifted towards racial and ethnic minorities, particularly among the Hispanic/Latinx migrant and agricultural workers. In May of 2020, Echols county reported nearly 4,700 infectious per 100,000 persons due to an outbreak associated with seasonal migrant farm workers who often are unable to socially distance in shared housing or in the fields (10). Per the Centers of Disease Control and Prevention's (CDC) review of meat and poultry processing facilities in April-May 2020, 14 poultry plants in Georgia reported 509 confirmed COVID-19 cases (case rate of 3084 per 100,000 persons) (11). The surveillance effort reported that 87% of those who were infected with COVID-19 were racial or ethnic minorities (12). To prevent further workplace associated

outbreaks, disease prevention recommendations were made to provide health and safety resources that were culturally appropriate, to encourage hand hygiene and personal protective equipment (PPE) use, to implement physical distancing (or barriers) between workers, and to provide sick leave for employees (13–15).

To complement these recommendations, the Emory COVID-19 Outbreak Response Team (ORT) established a partnership with the Mexican Consulate of Atlanta, whose services extends to Hispanic/Latinx people in the Southeast US. Through this collaborative effort, monthly "pop-up" COVID-19 test clinics were organized to provide free routine screening opportunities. This testing site was the first Latino specific testing site offered in the Atlanta area and provided native Spanish speakers for both registration and testing. In this paper, we provide descriptive assessment of the individuals who received at least one SARS-CoV-2 PCR test via anterior nares (AN) sample from September 2020 to February 2021. Additionally, we analyzed potential risk factors associated with a positive PCR test for COVID-19 among these individuals.

Methods

A matched case-control study was designed to evaluate the risk factors associated with having a positive SARS-CoV-2 PCR result among the population who received a free diagnostic test at the Mexican Consulate of Atlanta between September 2020 and February 2021.

Study Participants

For this analysis, individuals who received PCR analysis for SARS-CoV-2 at the Mexican Consulate of Atlanta were included. A temporary clinic was set up one Saturday a month by the Emory COVID-19 Outbreak Response Team (ORT) beginning in June of 2020. Data for this analysis are from the monthly clinics from September 2020 through February 2021. Over five COVID-19 clinics, 544 individuals received a SARS-CoV-2 PCR test at these testing events.

A total of 37 individuals received a positive PCR test for SARS-CoV-2 and were selected as cases for this study. For each case, two controls were selected from the same source population matched on the date of diagnostic specimen collection and age. The schematic for the study subject identification process is shown in figure 1.

Data Collection

As individuals arrived at the clinic location to receive a SARS-CoV-2 PCR test, a screening survey was given as part of the routine registration process. Individuals were asked to identify their demographics (i.e., age, sex, ethnicity, and race), history of known exposure within the past 14 days and occupation status to determine whether they classified as an essential worker (defined as employment at a hospital, in the food industry, or at airport). Symptoms

associated with COVID-19 infection were also collected and included: fever, cough, shortness of breath, loss of smell, loss of taste, headache, and diarrhea. The timing for these symptoms was restricted to the day of the specimen collection.

Specimen Collection and Analysis

For the clinical diagnostics, anterior nares (AN) swabs were collected by trained staff. Each nostril of an individual was swabbed using a flocked swab in a repeated circular motion for 10 circles per nares. Samples were kept at ambient temperature until processed using the BakoDx RT-PCR SARS-CoV-2 test for the detection of nucleic acid from SARS-CoV-2. The analysis of these specimens was done by Bako Diagnostics in Alpharetta, Georgia, a Clinical Laboratory Improvement Amendments of 1988 (CLIA) approved lab.

Statistical Analysis

Multivariable analysis using conditional logistic regression was used for this study. Analysis was conducted from the study population that was 2:1 matched on age and date of specimen collection. Additional factors chosen for consideration from the screening survey were prior known exposure to a positive COVID-19 case, occupational status, and reported symptoms. For the consideration of symptoms, the total number of experienced symptoms were calculated. Prior exposure to a known COVID-19 case, total number of reported symptoms, and occupational status were chosen as the exposure variables of interest with age as a confounding variable.

RStudio version 1.3.1073 was used for statistical analysis.

Results

Descriptive Epidemiology

Between September 2020 and February 2021, 544 individuals received a SARS-CoV-2 PCR test at the Mexican Consulate of Atlanta in collaboration with Emory COVID-19 Outbreak Response Team. For the analysis, 111 individuals were selected by matching cases and controls on the age and the date of specimen collection. All positive COVID-19 cases were included. During this time, the positivity rate ranged from 1.89% to 10% with the highest positivity on February 20, 2021 and the lowest being on September 26, 2020. The median age of the cases was 39.0 (IQR: 25.2-46.9) and controls was 39.1 (IQR: 24.5-46.8). Cases were equally distributed by sex (49% were women, n=20) while 54% of controls were women (n=40). Majority of the cases self-identified as Hispanic/Latino (93%). Baseline characteristics of the study population are shown in table 1.

Risk factors in the study population

Prior exposure to a known COVID-19 case was chosen as the primary exposure of interest given the known biologic plausibility. The total number of reported symptoms and occupational status were included as potential risk factors. A multivariable analysis of conditional logistic regression model considered age as a potential confounder. Additionally, interactions between identified confounding and exposure variables were considered but the effects were not statistically significant at 5% level for inclusion in the final model.

Fourteen cases and 10 controls reported a known exposure (38% vs. 14%). After controlling for age, the odds of having had an exposure in the past 14 days was three times higher for those with a positive test compared to those with a negative test (odds ratio (OR) =

2.98, 95% confidence interval (CI): 0.88, 10.15). 14 cases and 4 controls reported two or more symptoms associated with COVID-19 (38% vs. 5%). The odds of reporting two or more symptoms was 8.15 times higher among those with a positive test for COVID-19 than those with a negative test (OR=8.15, 95% CI: 1.74, 38.17). Alternatively, the odds of being an essential worker in healthcare, the food industry, or at the airport was 74% less for those who tested positive than those who tested negative (OR 0.26, 95% CI: 0.04, 1.87) though this was not statistically significant.

Discussion

This study included individuals receiving SARS-CoV-2 PCR testing at the Mexican Consulate of Atlanta between September 2020 and February 2021. 33% of people tested positive with test positivity ranging from 1.89 in September 2020 to 10% in February 2021. In the United State, over the same period, average percent positivity varied from 4% in September, 9-11% in November and December, and 6-8% in January and February. In Georgia, similar degree of sharp increase was observed with the peak of 14% test positivity in December (16). Comparison of test positivity between the study population, Georgia, and the United States is shown in figure 2.

As of March 7, 2021, Georgia reported race and ethnicity in 66% of reported cases and 86% of deaths. Of those with race/ethnicity data in Georgia, 13% of reported cases and 6% of reported deaths occurred among those who identify as Hispanic/Latinx, 32% of cases and 34% of deaths occurred among Blacks, and 48% of cases and 58% of deaths occurred among Whites (17). This analysis was done in a nearly exclusively Hispanic or Latinx population at the Mexican Consulate. Ninety-five percent (35/37) of the population self-reported as Hispanic/Latinx (Table 1). Due to lack of representation across other race or groups, this analysis could not meaningfully evaluate race or ethnicity as a risk factor.

Among the 111 individuals included in the analysis between September 26, 2020 and February 20, 2021, we found increased odds of having a known prior exposure within 14 days among those with a positive test result compared to those with a negative test (OR = 2.98; 95% CI: 0.88, 10.15). In addition to positive cases being more likely to have a known exposure, positive cases were also much more likely to report two or more symptoms on the day of

specimen collection (OR = 8.15; 95% CI: 1.74, 38.17). In the absence of collected data on individual's symptom severity, a composite score of the number of exhibiting symptoms was calculated. Having two or more symptoms on the day of specimen collection was used as a proxy for the more severe presentation of symptoms. Among 37 cases, 30% were asymptomatic at the time of specimen collection. The proportion of asymptomatic cases in our study population is lower than what has been seen in China where 44% of cases are asymptomatic (18,19). Given that this study included only those who sought COVID-19 testing and was not surveillance testing of an entire population, it is not surprising that most cases were either symptomatic or had a known previous exposure in the past two weeks. It is notable that all asymptomatic cases (n=11), except for one with prior exposure and two as essential workers, were identified without any other surveyed risk factors.

Essential workers have been a primary focus of the COVID-19 pandemic due to increased risk related to their occupation that required physical presence at their employment (20–22). According to the U.S. Bureau of Labor Statistics, Hispanic/Latino workers were disproportionately less likely to be able to work from home during the pandemic. 16.2% of Hispanic/Latino workers worked from home compared to 19.7% of non-Hispanic Black workers and 29.9% of non-Hispanic White workers (23,24). While early studies found that essential workers had a higher risk of contracting COVID-19 (22), this study found that working in essential industries such as healthcare environments, the food industry, or the airport were less likely to be associated with a positive COVID-19 tests (OR 0.26, 95% CI: 0.04, 1.87). Given that the dates of the testing events were after the initial stay at home orders in Georgia were removed, it is possible that most people were back to working in their business locations and not at home. This, as well as the rigorous personal protective equipment (PPE) and routine COVID-19

surveillance testing requirements at some workplaces that were put in place based on their increase risk of COVID-19 based on their employment status, may explain the protective effect seen in this analysis (25–28).

Contrary to the beginning of this pandemic, there was not a lack of COVID-19 testing resources between September 2020 and February 2021. With the abundance of testing resources available, we can surmise that those who sought COVID-19 screening were more likely to have sought testing for a specific reason such as having a known prior exposure or exhibiting respiratory symptoms, likely leading to selection bias in this sample. Given that there was a surge of tests and confirmed cases during the analytic period associated with holiday-related travel and gatherings, it could be that essential workers are no longer the primary drivers of this pandemic. While the biologic risk factors such as known exposure and clinical presentation of this disease remain, it is evident that social and behavioral risk factors change over time (1,29).

This study describes the weekend testing offered at the Mexican Consulate in partnership with Emory University from September 2020 to February 2021. In this almost exclusively Hispanic/Latino testing population, we found that a known exposure and two or more symptoms was associated with testing positive during the fall and winter of 2020-2021. Asymptomatic cases were not common. Essential worker status as we defined it (work in healthcare, the food industry or at the airport) was protective, likely reflecting that this far into the pandemic, the risk differential by work status had been mitigated. While this population had few asymptomatic cases, easily accessible testing remains a critical public health effort to curb the COVID-19 pandemic (30).

Table 1. Baseline characteristics of the study population

	COVID-19 PCR Result		
	Negative (N=74)	**Positive (N=37)**	**Overall (N=111)**
Sex (N, %)			
Women	40 (54%)	20 (49%)	60 (54%)
Men	34 (46%)	37 (51%)	51 (46%)
Age, years (median, range)	39.1 (24.5-46.8)	39.0 (25.2-46.9)	39.0 (24.7-46.9)
Occupation type (N, %) [a]			
Essential worker	9 (12%)	2 (5%)	11 (10%)
Non-essential worker	65 (88%)	35 (95%)	100 (90%)
Race and Ethnicity (N, %)			
Hispanic/Latino	68 (92%)	35 (94%)	103 (93%)
Asian, not Hispanic or Latino	1 (1%)	0 (0%)	1 (1%)
White, not Hispanic or Latino	3 (4%)	1 (3%)	4 (3%)
Other, not Hispanic or Latino	0 (0%)	1 (3%)	1 (1%)
Unknown	2 (3%)	0 (0%)	2 (2%)
Exposure (N, %)			
Known prior exposure	10 (14%)	14 (38%)	24 (22%)
No known prior exposure	64 (76%)	23 (62%)	87 (78%)
Number of reported symptoms (N, %)[b]			
0	66 (90%)	11 (30%)	77 (70%)
1	4 (5%)	11 (30%)	15 (14%)
≥ 2	4 (5%)	14 (38%)	18 (16%)

[a] Occupations considered essential were in healthcare, food industry, and airport

[b] Surveyed symptoms include fever, cough, shortness of breath, loss of smell, loss of taste, headache, and diarrhea

Table 2. Risk factors for positive SARS-CoV-2 PCR by conditional logistic regression in a matched comparison of 37 cases and 74 controls matched by age and date of diagnostic specimen collection, September 2020 – February 2021

	Controls (n=74)	Cases(n=37)	OR[a] (95% CI[b])
Previous exposure within 14 days	10 (14%)	14 (18%)	2.98 (0.88, 10.15)
Essential worker	9 (12%)	2 (3%)	0.26 (0.04, 1.87)
≥ 2 reported symptoms	4 (5%)	11 (15%)	8.15 (1.74, 38.17)

[a] OR = odds ratio

[b] CI = confidence interval

Figure 1. Schematic representation of the study population selection process

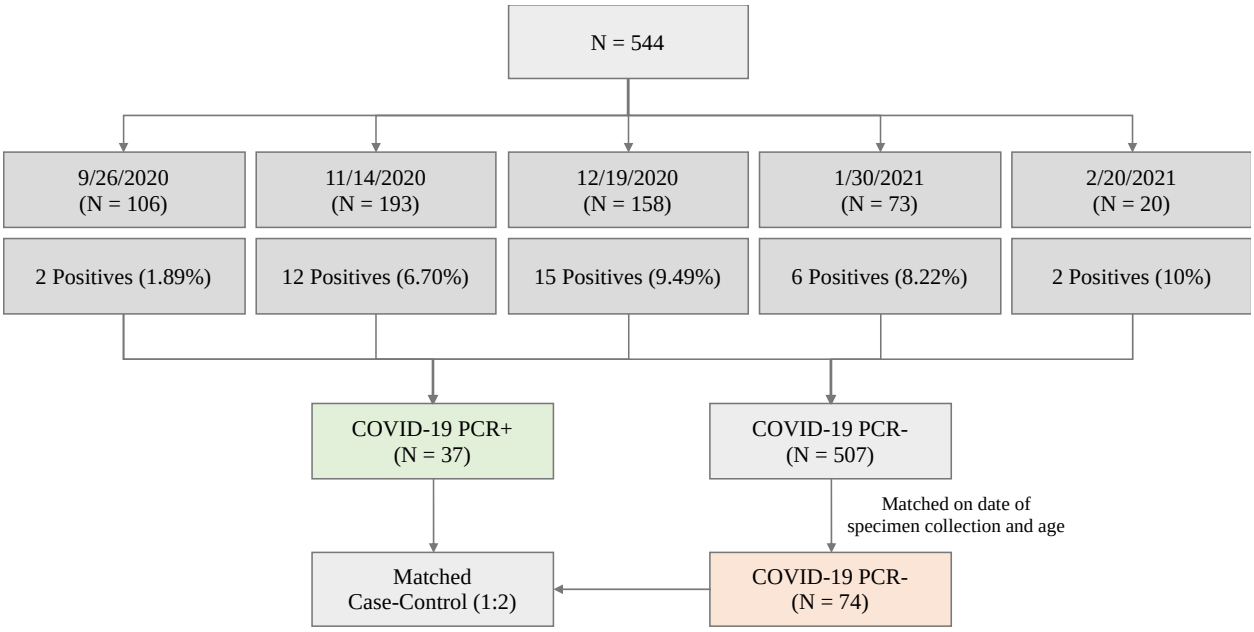
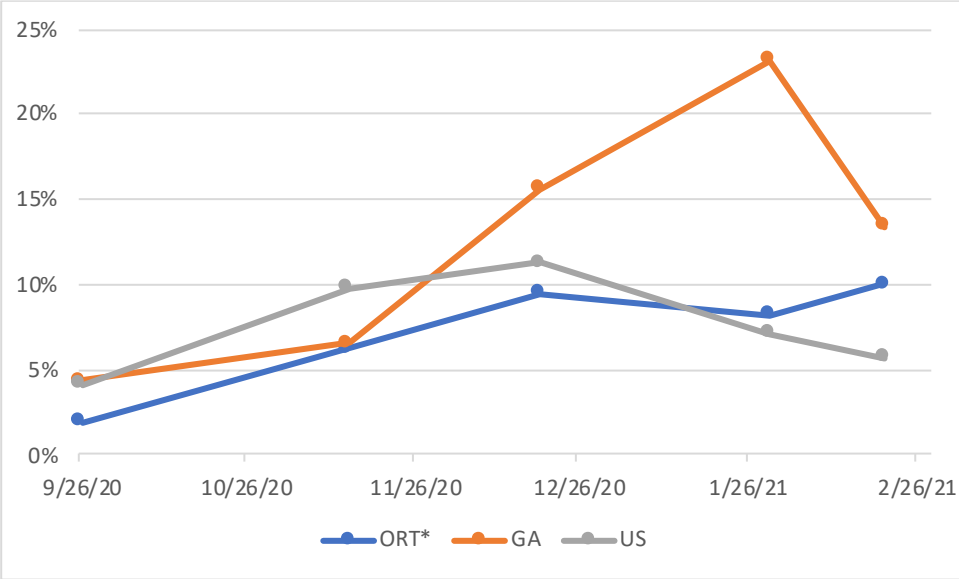


Figure 2. Comparison of COVID-19 positivity among the study population, Georgia, and the United States between September 2020 and February 2021



* ORT = Emory COVID-19 Outbreak Response Team testing events (study population)

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Appendix A. Conditional logistic regression modelling process

Model 1:

ln(odds of COVID-19 PCR+) = α + β1 PREVEXPOSURE
+ β2 ESSENTIALWORKER+ β3 SX
+ γ1 AGE + γ2 SEX
+ δ1 PREVEXPOSURE * ESSENTIALWORKER
+ δ2 PREVEXPOSURE * SX
+ δ3 ESSENTIALWORKER * SEX

Interaction assessment

Updated *model 2* (via backwards elimination by removing the 'least significant' interaction terms until all interaction terms are significant or all excluded):

ln(odds of COVID-19 PCR+) = α + β1 PREVEXPOSURE
+ β2 ESSENTIALWORKER+ β3 SX + γ1 AGE + γ2 SEX

Confounding assessment

Model	Dropped	OR PrevExp	OR Essential	OR Sx	≤10% of GS	Keep in GS?
GS	n/a	3.016	0.268	8.190	-	-
1	Sex	2.983	0.259	8.152	Yes	Drop

Updated *model 3* by removing non-confounding variables:

ln(odds of COVID-19 PCR+) = α + β1 PREVEXPOSURE
+ β2 ESSENTIALWORKER+ β3 SX + γ1 AGE

Final output

```
Call:
clogistic(formula = result ~ prevexposure + essentialworker +
    sx2 + age, strata = pair_age, data = cacol)



                  coef exp(coef) se(coef)      z      p
prevexposure     1.093     2.983    0.625  1.749 0.0800
essentialworker -1.350     0.259    1.007 -1.340 0.1800
sx2              2.098     8.152    0.788  2.664 0.0077
age             -0.247     0.781    0.417 -0.592 0.5500

Likelihood ratio test=23  on 4 df, p=0.000124, n=111
```

```
                                  2.5 %    97.5 %
prevexposure     2.9828213 0.87658893 10.149824
essentialworker  0.2592466 0.03599775  1.867028
sx2              8.1520914 1.74112334 38.168803
age              0.7814850 0.34537973  1.768253
```