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Clinical and epidemiological characteristics of SARS-CoV-2 Infection in Los Angeles County youth during the first year of the pandemic

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ABSTRACT

Objectives: The aim of this study was to characterize SARS-CoV-2 infection patterns in Los Angeles (LA) County youth followed at our institution during the first pandemic year.

Design: A prospective cohort of patients aged < 25 years who tested positive for SARS-CoV-2 using reverse-transcriptase polymerase chain reaction (RT-PCR) assays between March 13, 2020, and March 31, 2021, was evaluated at a large LA County health network. Demographics, age distribution, and disease severity were analyzed.

Results: There were 28,088 youth aged < 25 years tested for SARS-CoV-2 using RT-PCR, with 1849 positive results identified (7%). Among the positive results, 475 of 11,922 (4%) were identified at the pandemic onset (March–September 2020) (Cohort 1) and 1374 of 16,166 (9%) between October 2020 and March 2021 (Cohort 2), $P < 0.001$. When disease severity was compared across cohorts, Cohort 2 had a greater proportion of asymptomatic and mild/moderate disease categories than Cohort 1 (98% vs 80%, respectively); conversely, Cohort 1 had a near-10-fold higher proportion of severe disease than Cohort 2 (17% vs 1.8%). Cohort 2 comprised younger patients with a mean age of 13.7 years vs 17.3 years in Cohort 1. Older age was associated with a higher percentage of infection, with 63% of all confirmed cases found in participants aged 19 to 25 years in Cohort 1, compared with 38% of confirmed cases in Cohort 2. Age increase was also associated with greater disease severity by linear regression modeling ($P < 0.001$).

Conclusion: Coronavirus disease 2019 (COVID-19) disease severity in youth decreased over time in LA County during the first pandemic year, likely a reflection of changing demographics, with younger children infected. A higher infection rate in youth did not lead to higher disease severity over time.

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Introduction

With increased testing availability, studies show that children aged 5 years or older have SARS-CoV-2 infection rates similar to those of adults (Grijalva *et al.*, 2020; Kim *et al.*, 2021; Lugon *et al.*, 2021; Smith *et al.*, 2021; Zimmermann and Curtis, 2020). Multiple studies suggest that individuals aged younger than 25 years are more likely to have asymptomatic SARS-CoV-2 infections or mild

symptoms than older patients (Dawood *et al.*, 2022; Han *et al.*, 2021; Rosenberg *et al.*, 2020; Siebach *et al.*, 2021). Nevertheless, younger individuals still tend to shed SARS-CoV-2 with high viral loads in the upper respiratory tract that are comparable to or even higher than those reported in older adults (Somekh *et al.*, 2021). With the advent of new SARS-CoV-2 variants of concern (VOC), household transmission rates have increased with the introduction of more transmissible variants (Paul *et al.*, 2021). In one study, children aged 4 to 8 years and 9 to 13 years had increased odds of transmission, suggesting that children may play a larger role in SARS-CoV-2 transmission than older adolescents and adults (Stokes *et al.*, 2020).

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Los Angeles (LA) County is one of the largest and most socioeconomically diverse counties in the United States. It has more than 10 million residents, with youth (individuals aged < 25 years) comprising nearly one third of the population (US Census website). During the initial 6 months of the pandemic (March–September 2020), we conducted a prospective cohort study with case-control analyses in youth who received testing for SARS-CoV-2 at our academic institution in LA County (Newhouse et al., 2021). In this study, patterns of COVID-19 symptoms varied significantly by age group, with number of symptoms correlating significantly with age. Younger youth, who were students, were less likely to have positive results when compared with older youth, who were employed. In addition, cases were more likely to be from non-English-speaking households, zip codes with a higher proportion of Hispanic individuals, and residents living below the poverty line (Newhouse et al., 2021).

During the second half of the first year of the pandemic (October 2020–March 2021), LA County had a surge and reported the highest number of cases and deaths in all age groups in California, with 1,185,457 cases and 20,987 deaths (COVID19 Dashboard, 2022). In addition, novel SARS-CoV-2 variants became more predominant, including Alpha, Beta, and Gamma (Abdel Latif et al., 2021). By the end of the first year of the pandemic, the Delta variant was detected and started to increase in LA County. The presence of novel variants raised concerns for increased infectivity and virulence.

The purpose of this cohort study was to characterize the evolution of SARS-CoV-2 infection in LA County youth followed at our institution during the first year of the pandemic, comparing youth from the first 6 months and the second 6 months. There is an urgent need to collect more information on the immediate clinical repercussions of COVID-19 infection in youth and how the disease has evolved during the pandemic. A better understanding of how the disease presents over time in younger populations has important implications, given the development of VOC and the changing nature of the SARS-CoV-2 virus.

Methods

Population, Setting, and Data Collection

From March 13, 2020, until March 31, 2021, we conducted a cohort study of youth aged less than 25 years who tested positive for SARS-CoV-2 infection at our institution, which comprises a large academic medical center (Ronald Reagan Medical Center and Mattel Children's Hospital at UCLA), a community hospital (UCLA Santa Monica Hospital), and a widespread network of UCLA-affiliated clinics throughout LA County. Our primary outcomes of interest were disease severity and age distribution of illness in children and youth with a positive reverse-transcriptase polymerase chain reaction (RT-PCR) over time. All participants were tested for SARS-CoV-2 through RT-PCR assays. Each participant was only counted once in the cohort, even if more than one PCR test was performed. If a participant had multiple positive and negative results, the first positive recorded result was used. Confirmed cases of COVID-19 were defined as any positive RT-PCR result. Cohort 1 youth who tested positive for COVID-19 through RT-PCR in the initial 6 months of the pandemic, from March to September 30, 2020 (Newhouse et al., 2021), were compared with Cohort 2 youth of the same age who tested positive for COVID-19 in the second half of the initial year of the pandemic, from October 2020 to March 2021. This period coincided with a surge in SARS-CoV-2 cases in LA County in December 2020. Data abstracted from electronic medical records included demographics, zip code, clinical findings, and disease severity. All youth were classified as having asymptomatic, mild, moderate, severe, or critical COVID-19 according to the National Insti-

tutes of Health's Coronavirus Disease (COVID-19) Treatment Guidelines (COVID-19 Treatment Guidelines Panel, 2021). Study activities were approved by the UCLA Institutional Review Board (IRB).

Youth with a clinical diagnosis of multisystem inflammatory syndrome in children (MIS-C) were also evaluated and described separately (Centers for Disease Control and Prevention, 2021). Children with a MIS-C clinical diagnosis had either a positive RT-PCR or SARS-CoV-2 antibody test (without vaccination) or exposure to a person with suspected or confirmed COVID-19 within 4 weeks before the onset of symptoms (Centers for Disease Control and Prevention, 2021). All children with MIS-C had an RT-PCR and a serologic assay for SARS-CoV-2 performed.

Laboratory Testing

The UCLA Clinical Microbiology Laboratory performed all SARS-CoV-2 RT-PCR testing. Cycle threshold (Ct) values were analyzed for all positive RT-PCR tests; positive RT-PCR was defined as a Ct value < 40. For each patient with a positive result RT-PCR, the assay used and Ct values for each target were recorded. This method was previously described (Newhouse et al., 2021). In children with MIS-C, serologic testing for anti-SARS-CoV-2 immunoglobulin G (IgG) and immunoglobulin M (IgM) was also performed. Sera were analyzed by enzyme-linked immunosorbent assay to detect the spike receptor-binding domain with IgG and IgM as previously described (Newhouse et al., 2021).

Data Analysis

A descriptive analysis was performed of the demographics of all patients aged more than 25 years who had RT-PCR test results in our health system. To describe the total population of youth who received testing at UCLA, we conducted a chi-square test to compare basic demographic information among youth who tested positive for SARS-CoV-2 at our institution during the first and second waves of the pandemic. Disease severity was transformed into a numeric scale to examine severity as a continuous variable between cohorts, defined as Asymptomatic=1, Mild/Moderate=2, Severe/Critical=3, and Death=4. Individuals with no clinical data available in the medical records to generate a disease severity category or individuals tested outside of our institution were excluded from further analysis. Linear regression and correlation coefficients estimated the severity of symptoms by change in age, and β s between the regression lines for cases and controls were analyzed using a *t*-test.

For each zip code in LA County, we tabulated the proportion of residents of each race/ethnicity based on the most recent US census (Farris, 2020). Subsequently, we tallied the race/ethnicity of the highest proportion of the residents (hereafter "predominant ethnicity"). For each zip code, we calculated the total number of study participants tested for SARS-CoV-2 at UCLA during the first two periods of the pandemic, in addition to the number of tests that were positive. From these data, we calculated the mean positivity rate for all zip codes in each cohort. We subsequently classified each zip code as having above or below average positivity. The purpose of this analysis was that by leveraging these variables, we aimed to determine the number of zip codes with predominantly Hispanic or predominantly White residents with above average SARS-CoV-2 positivity rates in both cohorts during the pandemic.

Determination of VOC in LA County

Using genomic data on SARS-CoV-2 from the GISAID initiative, we calculated the frequency of SARS-CoV-2 VOC, Variants of Interest, and common lineages by month from March 2020 to March 2021 (Abdel Latif et al., 2021).

Table 1
Demographics, comorbidities, and disease severity in LA County youth during two pandemic periods.

CHARACTERISTICS	SARS-CoV-2 Positive (March–Sept 2020)		SARS-CoV-2 Positive (Oct 2020–March 2021)		P-value
	N=475		N=1149		
Sex	N	%	N	%	
Female	235	49.5%	559	48.7%	0.28
Male	239	50.3%	590	51.3%	
Not Specified	1	0.2%	0	0.0%	
Age group at testing					
<1	14	2.9%	43	3.7%	<0.001
1–5	49	10.3%	208	18.1%	
6–11	35	7.4%	177	15.4%	
12–18	78	16.4%	284	24.7%	
19–25	299	62.9%	437	38.0%	
Mean Age (SD)	17.3		13.7		<0.001
Race/ethnicity					
Asian	16	3.4%	42	3.7%	<0.001
Black/African American	29	6.1%	118	10.3%	
Hispanic/Latino	164	34.5%	600	52.2%	
White	133	28.0%	342	29.8%	
Other	35	7.4%	29	2.5%	
Unknown	98	20.6%	18	1.6%	
Type of Insurance					
None	30	6.3%	30	2.6%	<0.001
Medical/Safety Net	107	22.5%	308	26.8%	
HMO/Private	338	71.2%	811	70.6%	
Comorbidities					
Obesity (BMI > 98 th percentile)	46	9.7%	149	13.0%	0.06
Pulmonary	61	12.8%	113	9.8%	0.07
Cardiac	17	3.6%	39	3.4%	0.85
Other	132	27.8%	330	28.7%	0.71
None	275	57.9%	813	70.8%	<0.001
Occupation (Patient)					
Working	89	18.7%	84	7.3%	<0.001
Student	250	52.6%	952	82.9%	
Disabled	1	0.2%	26	2.3%	
Other	20	4.2%	0	0.0%	
Unknown	115	24.2%	87	7.6%	
Severity					
Asymptomatic	89	18.7%	305	26.5%	<0.001
Mild/ Moderate	291	61.3%	821	71.5%	
Severe	79	16.6%	21	1.8%	
Death	1	0.2%	2	0.2%	
Unknown	15	3.2%	0	0.0%	

BMI: body mass index; HMO: health maintenance organization; SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; SD: standard deviation.

Results

A total of 28,088 SARS-CoV-2 RT-PCR assays were performed in youth between March 13, 2020, to March 31, 2021 (Table 1 and Figure 1). A total of 1849 youth (7%) had positive PCR results during this period. This included 475 youth with positive results (4%) from 11,922 tested at the onset of the pandemic from March to September 2020 (Cohort 1) and 1374 youth with positive results (9%) from 16,166 tested from October 2020 to March 2021 (Cohort 2). Figure 1 depicts the overall number of youths tested and absolute cases over time. The number of youths who tested positive for SARS-CoV-2 was significantly higher (9% vs 4%, $p < 0.001$) in Cohort 2 than in Cohort 1, corresponding to the LA County's surveillance data (December 2020–February 2021 [COVID19Dashboard, 2022]). In Cohort 2, 225 youth had no clinical information available in the medical records and/or were tested at an outside facility, thus being excluded from further analysis. Data were analyzed for 1624 Cohort 2 youth.

Over time (Figure 2), there was a shift in the mean age of confirmed cases in the study population. In Cohort 1, the mean age was 17.3 years, whereas in Cohort 2, the mean age was 13.7 years (Table 1 $p < 0.001$). In both periods, the older youth (19–25 years) represented the largest age group of all confirmed cases, with 63% in Cohort 1 and 38% in Cohort 2, respectively (Table 1). Nevertheless, during the second half of the first pandemic year, a higher

proportion of younger youth tested positive than in the previous 6 months; this was especially notable in the group aged six to 11 years, in which positive results more than doubled, from 7.4% to 15.4% (Table 1 and Figure 2, $P < 0.001$). In addition, a statistically significant higher proportion of Cohort 2 youth aged from 1–5 years, 10.3% vs 18.1%, and 12–18 years, 16.4% vs 24.7%, tested positive than did youth in Cohort 1 (Table 1 and Figure 2, $P < 0.001$). A larger proportion of older youth (19–25 years) who tested positive in Cohort 1 were employed, especially as essential workers (older youth), than the youth in Cohort 2, in which most youth who tested positive were younger and students, with the proportion of working youth decreasing from 19% in the first cohort to 7% in the second cohort (Table 1, $p < 0.001$).

Most of the children and youth who tested positive for SARS-CoV-2 had mild or asymptomatic illness, regardless of study period. When both time frames are compared, youth testing positive in Cohort 2 had a greater proportion (98.3%) of asymptomatic or mild/moderate illness than did those in Cohort 1 (80%) (Table 1, $p < 0.001$). However, there was a 10-fold higher proportion of severe or critical illnesses in Cohort 1 than in Cohort 2, 16.6% vs 1.5% (Table 1, $p < 0.0001$). Using a linear regression model stratified for cohort, an increase in age was associated with the development of more severe disease. However, the first cohort saw a more drastic increase in disease severity with age ($B = 0.03$, $p < 0.001$, 95%CI 0.018, 0.035, $R = 0.26$) than the second cohort ($B = 0.004$,

Youth SARS-CoV-2 Testing by Week Mar 2020-Mar 2021

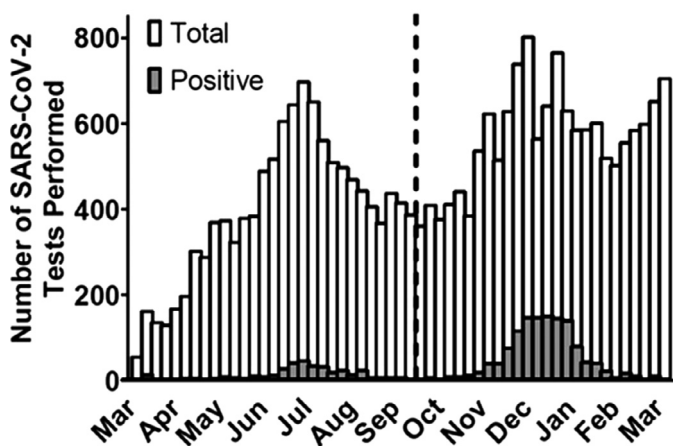


Figure 1. Increase in positivity over time during the first year of the pandemic, with the highest number of youth who tested positive identified during the pandemic surge in LA County (November 2020 to February 2021). From March 2020 to March 2021, 26,239 SARS-CoV-2 RT-PCR assays were performed in 28,088 patients aged less than 25 years, with 7% positive results. At the onset of the pandemic (March–September 2020), 4% of youth tested received a positive result (Cohort 1), and 9% of youth tested received a positive result between October 2020 and March 2021 (Cohort 2).

SARS-CoV-2 test positivity by age

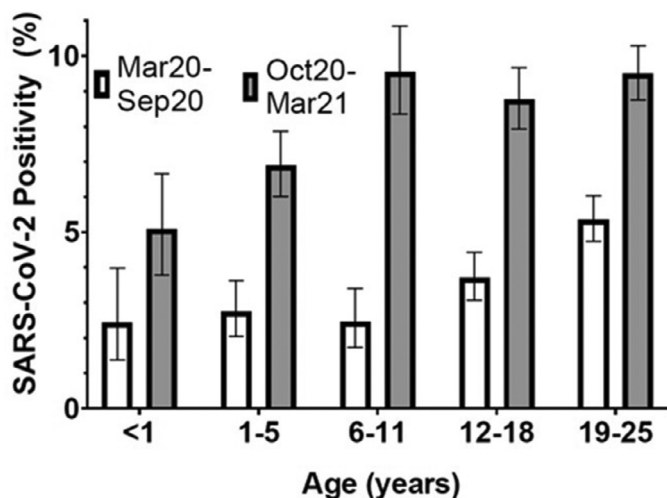


Figure 2. SARS-CoV-2 positivity by age among the two different waves. In the second period of the pandemic, there is more representation of younger-aged youth.

95% CI 0.002, $p=0.01$, $R=0.08$), R correlation comparison ($p<0.004$) (Figure 3 and Table 1). In total, three youth died because of COVID-19, with an overall case fatality of 0.18%. This included a boy aged 16 years with comorbidities and MIS-C in Cohort 1 (case fatality 0.21%) and two older youth (aged 19 and 23 years) with COVID-19 pneumonia (case fatality 0.17%). One youth was previously healthy, and the other had underlying comorbidities.

Race/ethnicity was available for 1508 youth with SARS-CoV-2 during the study period. Compared with other ethnic groups, Hispanic youth made up the largest group testing positive for SARS-CoV-2. There was a significant increase in the percentage of Hispanic youth who tested positive in Cohort 2 compared with Cohort 1, increasing from 34.5% to 52.2% (Table 1, $p<0.001$). The

proportion of Black/African individuals with SARS-CoV-2 also increased in Cohort 2 compared with Cohort 1, from 6.1% to 10.3% (Table 1, $p<0.0001$). The proportion of patients with White and Asian ethnicity remained relatively the same throughout both periods (Table 1), although zip code-specific analysis showed an increase in White youth in areas with above average SARS-CoV-2 positivity (Figure 4C).

Zip codes with a higher proportion of Hispanic residents and/or residents living below the poverty line had a higher number of SARS-CoV-2 cases during both study periods (Figure 4, panels A and B). In Cohort 2, there were more areas of LA County impacted with a greater spread of SARS-CoV-2 infection in youth across the county, with the inclusion of more affluent neighborhoods (Figure 4, panels A and B). In Cohort 2, a greater number of White youth than Hispanic youth tested positive within their respective zip codes (Figure 4, panel C), which reflects a broader socioeconomic and ethnic distribution of infected youth in the second half of the first pandemic year. In addition, there was a higher proportion of patients with Medical/Safety net insurance in Cohort 2 than in Cohort 1, 26.8% vs 22.5%, respectively (Table 1, $P<0.001$). The proportion of insured and uninsured youth testing positive for SARS-CoV-2 during the two periods did not differ enough to achieve statistical significance.

From October 2020 to March 2021, several SARS-CoV-2 VOC emerged over time (Figure 5). In the first two months of the second half of the first year of the pandemic, the most common strain circulating in LA County was the Epsilon variant (B.1.247 and B.1.249). As the surge continued, other predominant variants, including the Alpha variant (B.1.1.7), started emerging. By the end of the study period, the Delta variant (B.1.617 and its derivative lineages) had begun to emerge (Abdel Latif et al., 2021).

A total of 11 cases of MIS-C were identified over the study period in 1624 youth (0.68%). In Cohort 1, there were three patients with MIS-C with an average age of 12.5 years, with two boys affected. Two of the children were healthy, whereas the third youth had a chronic medical condition that required immune suppression. This patient died after a complicated hospital course. In Cohort 2, there were eight patients with MIS-C with an average age of 8.62 years, 62.5% male sex, and mainly Hispanic/Latinx ethnicity (75%). Two of the eight patients had underlying medical disorders with a predisposition to severe SARS-CoV-2 infection, but in Cohort 2, all children with MIS-C survived.

Discussion

During the first year of the COVID-19 pandemic in LA County, there was a change in age distribution, demographics, and clinical presentation of disease between the first and second six months of the initial year of the pandemic. In the first half of the year, most youth tested at our health system were older, aged between 19 and 25 years, with a higher positivity rate observed in this age range, consistent with trends in the distribution of COVID-19 at the time (Centers for Disease Control and Prevention [CDC], 2022). However, in the second 6 months, the proportion of children and youth aged younger than 15 years who tested positive for SARS-CoV-2 nearly doubled.

Many factors may have contributed to the higher number of children and younger youth testing positive in LA County in the second half of the pandemic, such as lockdown restrictions set in the first half of the pandemic being removed; children returning to school and other social activities; and possibly the emergence of SARS-CoV-2 VOC with greater infectivity leading to potentially higher infections in younger children. As may be surmised, differential infectivity of pediatric age groups has important implications for infection prevention within households and in schools/child care to minimize risk of household secondary transmission. In a

Correlation coefficient of disease severity by age in each cohort

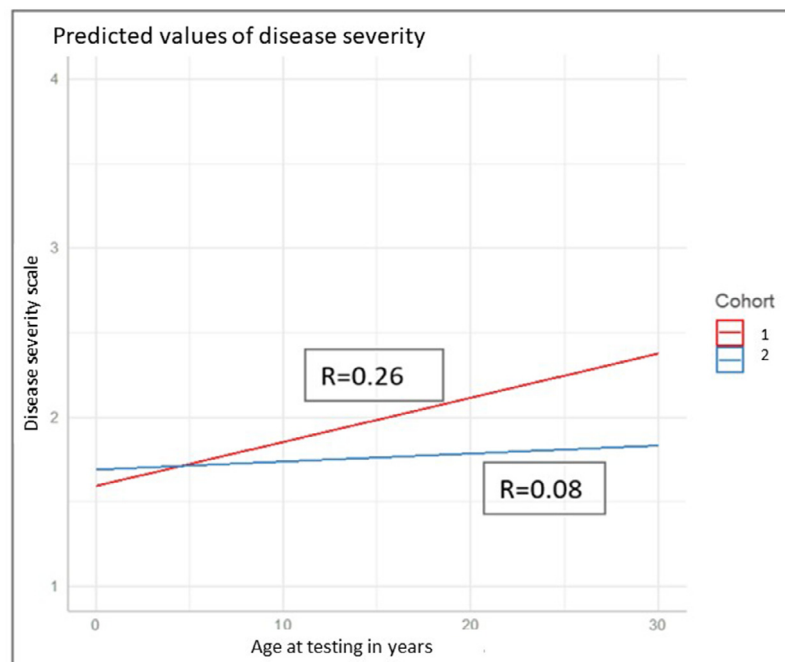


Figure 3. In an analysis of correlation coefficients of disease severity and age, increase in age was associated with development of more severe disease. Severity was transformed into a numeric scale to examine severity as a continuous variable between cohorts, defined as Asymptomatic=1, Mild/Moderate=2, Severe/Critical=3, Death=4. The first cohort saw a more drastic increase in severity with age ($R=0.26$, 95%CI 0.018, 0.035) than the second cohort ($R=0.08$, 95% CI 0.002, 0.008). R correlation comparison ($p<0.004$).

study among children and adolescents from the Modena province of Italy, of those participants who underwent nasal SARS-CoV2 PCR testing, 84.2% reported close contact with a cohabiting relative with infection, and 45.3% were symptomatic (Paduano et al., 2021). Furthermore, children and adults have been demonstrated to have similar incidence rates of SARS-CoV-2 infection (Dawood et al., 2022), which underscores the need for a rapid evaluation of vaccine efficacy and safety in children to expand vaccine indications to younger age groups.

Although one would expect that more severe cases would be noted with a higher number of infections in Cohort 2, during the pandemic surge, cases of COVID-19 in youth tended to be milder and often asymptomatic. As such, the proportion of severe/critical cases in youth diminished significantly, likely owing to the age shift to younger age groups during the second period of the initial year of the pandemic. This finding was corroborated by our linear regression model, which demonstrated an increase in age was associated with development of more severe disease; this was particularly striking in Cohort 1 early in the pandemic. Our results likely reflect a larger representation of younger children in the second half of the first year of the pandemic, which is consistent with previous studies showing that youth tend to have milder symptoms or be asymptomatic (Bailey et al., 2021; Choi et al., 2020; Dawood et al., 2022; Kim et al., 2020; Lazzarini et al., 2021). Even though a rare complication of COVID-19, cases of MIS-C typically peak several weeks after COVID-19 surges in the community. Not surprisingly, during the surge period in the second half of the year, we noted a higher number of MIS-C cases in Cohort 2. MIS-C cases were, nevertheless, exceedingly rare (0.68% cases in the entire cohort).

Although severe cases of COVID-19 can occur in children, adolescents, and young adults, most cases in younger age groups appear to be milder infections than those in adults aged 25 years

or older (Liguoro et al., 2020; Mehta et al., 2020; Stokes et al., 2020). In a systematic review of 18 studies evaluating symptoms and signs of COVID-19 in children and youth aged less than 20 years with documented infection, the proportion of asymptomatic infections ranged from 15 to 42% (Viner et al., 2020). Consequently, symptoms in children may often go unrecognized before a laboratory diagnosis is made (Han et al., 2021). With universal testing for SARS-CoV-2 upon admission to most hospitals, the rates of hospitalization for SARS-CoV-2 in children can be overestimated if hospitalizations for COVID-19-related illness are not differentiated from hospitalizations caused by situations in which incidental detection of SARS-CoV-2 occurs (Webb and Osburn, 2021; Woodruff et al., 2021). In CDC surveillance studies of COVID-19 in the United States, the presence of underlying medical conditions has been associated with higher rates of hospitalization among youth with comorbidities (15 to 22%) than among youth without these findings (2 to 4%). Whether underlying conditions are associated with increased severity or only a lower threshold for admission owing to concerns for complications is not known (Centers for Disease Control and Prevention [CDC], 2022; Kim et al., 2020; Webb and Osburn, 2021; Woodruff et al., 2021).

Children from underrepresented racial and ethnic groups have been disproportionately affected by higher rates of SARS-CoV-2 infection (Newhouse et al., 2021; Van Dyke et al., 2021). In one study of LA County urban children and youth aged less than 18 years, from June to December 2020, children were found to play an important role as index cases. Secondary attack rates were disproportionately impacted by household income (Tanaka et al., 2021). Furthermore, in a large US pediatric cohort study, children of Black, Hispanic, and/or Asian race/ethnicities had lower rates of testing than did White children but were significantly more likely to have positive test results (Bailey et al., 2021). In our analysis, Hispanic youth made up the largest ethnic group to test positive during

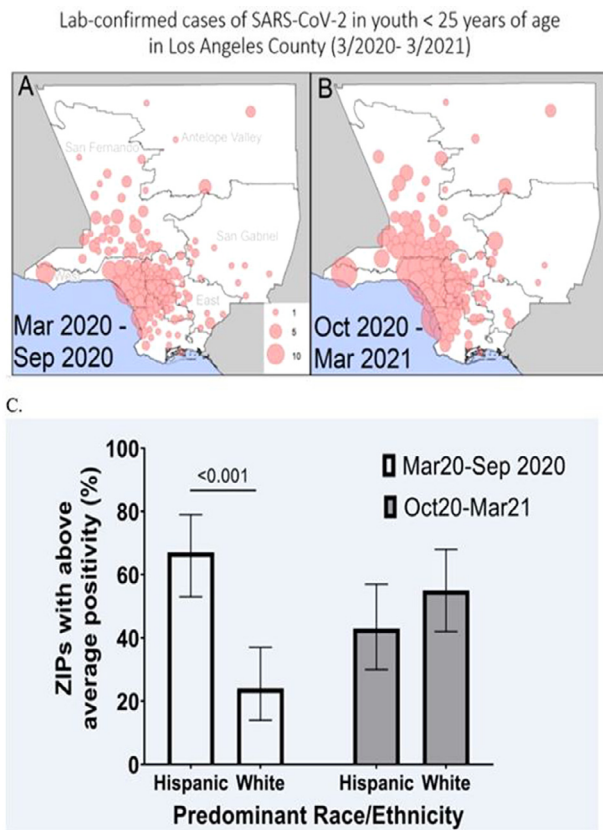


Figure 4. 4A and 4B: Comparison of Zip codes of youth infected by SARS-CoV-2 in two periods in the first year of the LA County pandemic. With the second wave, there is a greater spread and distribution to multiple neighborhoods in the county. 4C: When comparing the two periods of the pandemic, there is a greater percentage of positivity among Whites by zip code analysis in the second period.

the first year of the pandemic in LA County. However, with geographic epidemic modeling, when comparing both Cohorts 1 and 2, we noted an increase in the number of infections in youth from many ethnic groups and all socioeconomic classes, likely reflecting the impact of the pandemic surge during that period.

To the best of our knowledge, our cohort study is the first to characterize the evolution of SARS-CoV-2 infection in LA County youth followed at our institution during the pandemic. The study has several strengths, including a large sample size of ethnically and socioeconomically diverse youth with RT-PCR-confirmed SARS-CoV-2 infection. We were able to report on youth iden-

tified during different periods of the pandemic, with sufficient data to characterize COVID-19 outcomes in this studied population, demonstrating an association between age and risk of disease severity even among young individuals.

Although our patients came from socioeconomically diverse areas of LA County, having been recruited from a vast network of clinical centers and two hospitals, one study limitation is that our data come from a single institution. As a tertiary medical center, we have a pediatric patient population that tends to be more medically complex than the general population. Another study limitation is that 225 youth in Cohort 2 (14% of participants who tested positive during that period) were excluded from our analysis for lack of clinical data and/or because of testing performed at an outside institution, thus not meeting the eligibility criteria for study inclusion. During the study period, antigen testing for SARS-CoV-2 was not performed at our institution, and only RT-PCR results were evaluated. It is likely that these individuals were asymptomatic, given the lack of additional clinical information; however, we are unable to confirm this assumption. Our analysis predates the evaluation of the impact of vaccine administration to youth because patients in this age group began to be immunized in April 2021, which is after our study period ended. Therefore, we cannot extrapolate our study findings to populations exposed to COVID-19 vaccines.

In summary, we characterized the SARS-CoV-2 infection in youth during the first year of the pandemic, including a winter surge period in LA County. An increased proportion of younger children became infected with SARS-CoV2 virus as the pandemic unfolded. Interestingly, although the number of cases of COVID-19 in youth increased 2.4-fold during the 2020-2021 winter surge, and one would expect to see a higher number of sicker youths, a significant reduction in disease severity was noted during this period. This reflects higher infection rates in younger age groups. Future analysis of disease presentation in youth during subsequent COVID-19 pandemic periods should determine if this disease pattern continued to prevail with the availability of vaccines to this population.

Ethical approval

The study was reviewed and approved by the UCLA Institutional Review Board.

Declaration of Competing Interest

The authors have no competing interests to declare.

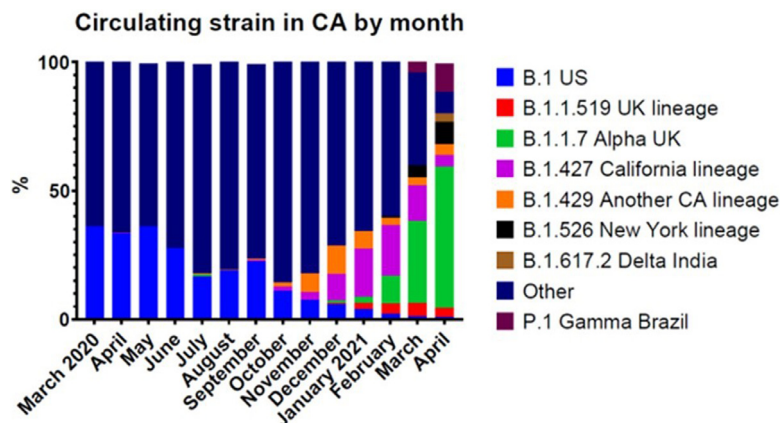


Figure 5. Different variants circulating by month in LA County from March 2020 to March 2021.

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