# SARS-CoV-2 Infections and Reinfections among Fully Vaccinated and Unvaccinated University Athletes – 15 States, January – November 2021

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## Abstract

### Background

Limited data currently exist on SARS-CoV-2 infections among fully vaccinated persons or reinfections in college-aged populations. CDC partnered with National Collegiate Athletic Association (NCAA) institutions to analyze retrospective data and present characteristics of positive COVID-19 cases among student athletes 18 years of age and older.

### Methods

De-identified, individual-level data contributed by 21 universities on 1378 student athletes who tested positive for SARS-CoV-2 from January through November 2021 (pre-Omicron) were examined to determine percentages of infection among unvaccinated, partially vaccinated, and fully vaccinated individuals (breakthrough infections) as well as reinfections. Comparisons by demographic characteristics and regions were also made to further characterize these infections.

### Results

Among the 1378 student athletes positive for SARS-CoV-2, 1070 (77.6%) were infected when unvaccinated and 22.4% (N=308) were infected after full vaccination. There was a significant difference between Black (14.7%, n=40) and White (23.9%, n=168) student athletes who experienced a COVID-19 infection after being fully vaccinated ($p<0.01$). Proportions of infections among fully vaccinated individuals did not differ statistically by sex ($p=0.06$).

### Conclusions

This paper adds to the knowledge of COVID-19 infections among fully vaccinated individuals in college-aged populations. The level of infections among fully vaccinated student athletes indicates the need for maintaining precautions to prevent infection. Further study of COVID-19 vaccination, infection, and reinfection among the well-resourced and diverse population of student athletes might contribute further understanding of factors that play a role in health equity among young adults.



**Keywords:** COVID-19, breakthrough infection, young adults, NCAA

## BACKGROUND

Collegiate athletics programs that engage young adults in training and competition while they study and socialize with other students present many challenges to the control of infectious diseases.[1] Student athletes come into close contact with others during practice and competitions, which could increase their risk of infection. In addition to the exposure risk from sports, they also spend time in high-density common campus areas like dining halls, classrooms, and residential spaces where transmission might be likely to occur. At the same time, the structured lives of student athletes and their high level of general health present unique opportunities to understand the dynamics of illness transmission that can inform strategies across student populations.

The coronavirus disease 2019 (COVID-19) pandemic raised concerns regarding the ability of athletic programs to safely remain open and protect the health of athletes and staff. The National Collegiate Athletic Association (NCAA) led efforts to prevent the spread of COVID-19 infections and exposures among student athletes with early and comprehensive recommendations for contact tracing, isolation and quarantine, screening testing and surveillance testing, and vaccination. The NCAA provided routinely updated guidance for athletes, coaches, and staff throughout the pandemic that closely followed CDC guidance, but also provided enhanced recommendations for surveillance testing of symptomatic and asymptomatic individuals.[13] NCAA guidance strongly recommended vaccination for all student athletes and frequent testing for student athletes who were unvaccinated.

Institutions of higher education were required to follow all local and state guidance as well as any additional campus policies. State and local policies superseded NCAA-wide and federal CDC guidance. Due to varying policy requirements at multiple levels, the ability to implement

testing programs, vaccination requirements, and other prevention measures varied by state, conference, and institution. The outcomes of the early and comprehensive prevention efforts of the NCAA showed that athletic program activities may be carried out without an increased risk of infection among student athletes compared with their nonathlete peers.[2,3]

In August through December 2020 COVID-19 test weekly positivity among U.S. young adults (aged 18-24 years) increased from approximately 7% to nearly 17%,[4] the highest positivity among all age groups during that time. Yet the highest COVID-19 test positivity among college athletes in the 2020-2021 academic year as reported in Schultz et al[2] was 0.8%. The enhanced prevention measures and high rates of surveillance testing that athletics programs put in place during the 2020-2021 academic year in order to adhere to NCAA guidelines might have contributed to the much lower rates of positivity among athletes during this time.

COVID-19 vaccines are effective at decreasing rates of infection, serious illness, and death; however, like other vaccines, they are not 100% effective in preventing these outcomes.[6] As new variants continue to emerge, additional information is needed related to COVID-19 reinfection and infections among individuals who are up-to-date on vaccinations. The objective of this study was to employ retrospective testing data to further characterize COVID-19 reinfections and infections in the student athlete population.

## METHODS

CDC partnered with representatives of five NCAA conferences (Atlantic Coast Conference (ACC), Big Ten Conference (Big 10), Big Twelve Conference (Big 12), Pacific Twelve Conference (Pac-12), Southeastern Conference (SEC) to analyze retrospective data on positive COVID-19 cases collected by participating colleges and universities. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC

policy.[1] Conferences were provided a data dictionary to standardize data collection (See Supplementary Table 1) to gather individual student athlete information on demographics, date of COVID-19 testing, test results, dates of vaccination, and vaccine type. Deidentified, individual-level retrospective data for student athletes testing positive for COVID-19 was received by CDC from three conferences (Big 12, Pac-12, SEC) including 21 colleges and universities (32.3% of all institutions in the 5 conferences, n=65). Two conferences (Big 12, SEC) included all positive cases from participating institutions; one conference (Pac-12) included all positive cases from athletes who consented to have their information recorded in the conference database. In addition to individual-level demographic data for each deidentified case including sex, race, and sport (see Supplemental Table 1), vaccination status was obtained from individual institutions by student athlete self-report. The following racial categories were included for analysis: Asian American and Native Hawaiian Pacific Islander (hereafter, ANHPI), Black/African American (hereafter, Black), two or more races (hereafter, Multi-racial), and White. American Indian Alaska Native were included for overall analysis, but excluded for pairwise comparisons due to small sample size (n=2). Ethnicity was not assessed due to a high level of missing data. Requirements for proof of vaccination status (such as uploading a copy of vaccination card or presenting to medical staff) varied from institution to institution. Work status of student athletes was not collected for this sample.

The dataset included COVID-19 positive cases for student athletes ranging in age from 18 to 27. The total number of all athletes from all participating schools, and thus the overall vaccination and infection rates for all athletes, was not available due to the time range of the data set crossing

[1] See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

over two academic years (Spring 2021=AY2020-21, Fall 2021=AY2021-22) and the subsequent fluctuation in athlete numbers due to graduation, students transferring in or out of an institution, and new incoming students in the fall. It should also be noted that the timespan of the data set includes positive COVID-19 cases from the months before COVID-19 vaccines were widely available to the general public (January-early April 2021).

Institutions changed testing policies over time in accordance with local, state, federal, and NCAA guidance. Not all institutions conducted surveillance testing for the entire population of student athletes within their athletics program on the same frequency; many focused testing on those teams that were in-season. Differences in testing policies and vaccination requirements varied for the athletics programs captured in the dataset (e.g., whether programs tested asymptomatic or only symptomatic individuals; frequency and coverage of surveillance testing for off-season student athletes). Given these factors, the study team determined that calculations of aggregate numbers of student athletes would not be advisable, and all findings presented here focus on characteristics of students included in the dataset of positive COVID-19 cases.

Additionally, due to the differences by institution in prevention polices and testing, as well as the variation in numbers of athletes for any given sport across institutions, analyses by individual sport were not included in this report.

Data cleaning and analyses were conducted using SAS (version 9.4; SAS Institute). For this analysis, only athletes with a positive test result between January 1 - November 30, 2021, before widespread circulation of the B.1.1.529 (Omicron) variant, were included. Athletes were excluded if their vaccination status was unknown. Testing was performed on student athletes throughout the time period from January through November, including summer months, because certain sports' training and competition schedules extend beyond the typical academic year

through the months of May-August. Student athletes received either Pfizer-BioNTech, Moderna, or Johnson & Johnson's Janssen COVID-19 vaccine.

For all athletes who received a positive COVID-19 test result, analyses of cases among persons who were fully vaccinated were conducted by separately calculating the interval from the date of being fully vaccinated (two weeks after completing a two-dose series of an mRNA vaccine [Pfizer-BioNTech or Moderna] or two weeks after completing one-dose of an adenoviral vector vaccine [Johnson & Johnson's Janssen]) to receiving a positive COVID-19 test. Individuals who had a positive case after receiving only 1 vaccine in a 2-dose mRNA vaccination series were categorized as partially vaccinated and not considered infections among fully vaccinated individuals for purposes of this analysis. Positive tests were either antigen, polymerase chain reaction (PCR), or a combination of antigen with confirmatory PCR depending on conference and institution. Individuals who received a booster dose were excluded from the sample due to low representation (n=4). Cases were considered a reinfection if the athlete had positive test results >90 days after receiving a previous positive test result. Individual colleges and universities were grouped by region as defined by the Department of Health and Human Services (HHS). Institutions in HHS Regions 7 and 8 were grouped together in analyses due to the lower sample located in these regions. Chi-square analyses were conducted to compare vaccination status, reinfection, and infections among fully vaccinated by demographic characteristics. Contrast analyses were conducted to determine significant differences between groups. Results were considered statistically significant at a p=0.05.

## RESULTS

*Vaccination Status*

The dataset included 1378 individuals with positive COVID-19 tests during January 1-November 30, 2021. This included unvaccinated (n=440, 31.8%), partially vaccinated (n=92, 6.80%), and fully vaccinated (n=846, 61.4%) individuals (Table 1); note that these numbers do not reflect vaccination status at the time of infection. Among the 846 fully vaccinated individuals who tested positive for COVID-19, 521 (61.6%) received Pfizer-BioNTech, 200 (24.0%) received J&J/Janssen, and 125 (14.8%) received Moderna. A total of 308 (22.4%) individuals were fully vaccinated at the time of COVID-19 infection, and 538 (39.0%) individuals became fully vaccinated after COVID-19 infection.

Across demographic categories, few differences were found in vaccination proportions (fully vaccinated vs. not fully vaccinated) in our dataset (Table 1). Among females, 61.7% (n=356) were fully vaccinated, and among males 61.1% (n=489) were fully vaccinated (p=0.7133). Percentages of vaccination were similar across racial categories as well, with 64.0% (n=174) of Black athletes, 62.5% (n=439) of White, 62.5% (n=35) of ANHPI, and 75.4% (n=43) of Multi-racial athletes fully vaccinated (p= 0.28).

A statistically significant difference in percentages of vaccination was shown across years of age in the dataset of positive cases, with differences between the youngest (64.7%, n=231) and oldest (44.4%, n=60) student athletes ($p<0.01$) and oldest and mid-age (62.0%, n=536) student athletes ($p<0.01$). There were no statistical differences between the youngest and mid-aged student athletes (p=0.037). Percentages vaccinated across HHS Regions ranged from 46.4% (n=65) of individuals in Regions 7 and 8 (Region 7 = Iowa, Kansas, Missouri, Nebraska; Region 8 =

Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming; combined here due to small sample) to 70.1% (n=202) in Region 10 (Region 10 = Alaska, Idaho, Oregon, Washington).

***Infections Among Fully Vaccinated Individuals (Breakthrough Infections)***

The participating NCAA conference partners were interested in understanding infections among fully vaccinated individuals, or what are colloquially called "breakthrough infections." Of the total 1,378 COVID-19 positive cases, 308 occurred among individuals who were fully vaccinated at time of infection (Table 1). No significant differences were identified in proportions of infections after full vaccination by sex, with 24.3% (n=140) of all females and 20.9% (n=167) of all males in the dataset of positive cases experiencing a COVID-19 infection after being fully vaccinated (p= 0.06).

There was a significant difference between Black (14.7%, n=40) and White (23.9%, n=168) student athletes who experienced a COVID-19 infection after being fully vaccinated (p<0.01) and Black and Multi-racial (26.3%, n=15) student athletes (p= 0.03). No differences were found between ANHPI and Black (p=0.93), Multi-racial and White (p=0.68), and Multi-Racial and Asian (p=0.12) student athletes who experienced a COVID-19 infection after being fully vaccinated. The highest number of infections among fully vaccinated individuals occurred in August 2021 (29.7% of all infections among vaccinated individuals) and September 2021 (30.3% of all infections among vaccinated individuals), coinciding with the start of the school semester and the Delta variant surge (Table 2).

Significant differences were found in the proportions of infections after full vaccination for those who received the J&J/Janssen vaccine (45.0%, n=90) compared to those who received Pfizer (31.2%, n=178; p< 0.01) and Moderna (23.8%, n=40; p<0.01). The median number of weekss elapsed after vaccination were 16 weeks for J&J (range: 2.1-36.6 weeks), 16.6 for Pfizer

(range: 2.0-35.0 weeks), and 17.3 weeks for Moderna (range: 3.7-29.3 weeks). All categories of age showed significant differences in infection after being fully vaccinated: youngest (27.1%, n=97) and oldest (12.6%, n=17) fully vaccinated student athletes ($p<0.01$), youngest and mid-aged students (20.7%, n=179) ($p=0.01$), and mid-aged and oldest students ($p=0.03$).

Across the HHS Regions (See footnote to Table 1 for states corresponding to regions), Region 4 had the highest percentage of infections among fully vaccinated student athletes in the dataset at 36.6% (n=83). Region 10 had the lowest percentage of infections among fully vaccinated student athletes in the dataset at 5.6% (n=16).

Only 11 (0.8%) student athletes experienced a reinfection in this pre-Omicron cohort, defined as an individual who had more than one positive COVID-19 test result and >90 days between positive tests, regardless of vaccination status. The average time from a first to a second infection was 197.5 days, or about 6.5 months (range: 95-301 days). Of the 11 reinfected cases, 3 were never vaccinated and 1 was partially vaccinated. Seven individuals experienced both COVID-19 infections prior to becoming fully vaccinated; no one in the dataset had two or more infections after being fully vaccinated. No individuals had three or more infections.

## DISCUSSION

From the dataset of 1378 student athletes with a positive COVID-19 test result, 31.9% (n=440) were unvaccinated, 6.80% were partially vaccinated (n=92), and 61.4% were fully vaccinated (n=846) by the end of the study period. Among the 846 fully vaccinated individuals in the data set of positive COVID-19 cases, only 36.4% (n=308) of fully vaccinated individuals in the dataset experienced a COVID-19 infection after vaccination. Those who received the J&J/Janssen vaccine (45.0%, n=90) were significantly more likely to have infection after full vaccination occur compared to those who received Pfizer (31.2%, n=178; $p< 0.01$) and Moderna

(23.8%, n=40; p<0.01). Given that the time ranges from vaccination to infection were similar across all vaccine types, this seems to indicate more quickly waning immunity for the J&J vaccine among individuals in our dataset. The lower rate of vaccine effectiveness for the J&J vaccine as compared to the mRNA vaccines during this time period might also have contributed to differences found here.[16] Our findings appear to be consistent with the existing literature on breakthrough infections caused by the Delta variant and its higher transmissibility, especially as COVID-19 vaccine effectiveness began to decrease over time and before boosters were recommended to the public.[17]

Infections among fully vaccinated individuals (i.e., infections after full vaccination) in the dataset of positive cases were statistically more likely among fully vaccinated younger student athletes (18yo/44.0%) compared to the oldest student athletes in the dataset (≥23yo/12.6%) (p <.001). Behavioral differences between ages are postulated to be the cause of the difference, although they were not studied in this analysis. No significant differences were identified in proportions of infections among fully vaccinated individuals by sex.

A statistically significant difference between categories of race was found among athletes who had a COVID-19 infection after being fully vaccinated. However, we believe this difference is largely driven by some of the limitations of the sample (discussed below), including the greater testing rates for in-season sports, which might have affected the sample depending on primary racial makeup of various sports, and in differences among both testing policies and racial diversity across institutions and states. While some differences were seen in percentages of cases among student athletes by HHS Region in the dataset, these aligned with overall cases by HHS Region, generally, for this time period according to data from the CDC COVID-19 Data Tracker website (CDC COVID Data Tracker).The data collection period stretched from January 2021,

before vaccines were available to student athletes, until November 2021, including the Delta variant surge but excluding the Omicron variant surge. Infections and reinfections for individuals up to date on vaccinations appear to occur more frequently following the increase in Omicron variant cases.[14, 15]

The balance of training, competition, coursework, and social activities that student athletes regularly face became even more challenging over the course of the COVID-19 pandemic. Coaches, trainers, and athletic staff support student athletes' health by providing guidance, assisting in making appointments for medical care, and ensuring their general health and well-being in order to remain healthy for participation in athletic activities. However, the lives of student athletes extend into other on-campus and off-campus spaces where prevention measures might not be adhered to as comprehensively. For this reason, campus-wide messaging regarding COVID-19 prevention measures can benefit student athletes as well as the general student body to help slow the spread of COVID-19 across campus, particularly during social activities. The percentages of infections among fully vaccinated student athletes reported here also indicates that the population cannot rely on vaccines alone to prevent transmission of COVID-19..

The findings of our analysis also have possible implications for health equity. Addressing social determinants of health and improving health equity encompass many different factors and aspects of life, not all of which we can take into account here. However, the unique, structured context of athletics programs on campus does show how holding some factors constant that contribute to health equity can make a difference for certain social categories. In general, student athletes tend to show a high degree of diversity across many demographic categories such as sex and race, which is also shown in our dataset. All individuals in this study received medical care through their collegiate athletics programs and had access to a high level of education, nutrition,

housing, and other resources on their campuses as student athletes in top-level NCAA conferences. In contrast to the general population, this study provides a way to hold environmental factors (food, shelter, education, health care) relatively constant in assessing variation across elements related to COVID-19 among social categories. Our analyses showed very little difference in percentages of vaccination across sex or race among cases, possibly implying that percent vaccinated among all athletes (i.e., cases and non-cases) was similar, in contrast to the disproportionate levels of COVID-19 vaccination seen in the general U.S. population. For example, the CDC COVID Data Tracker (CDC COVID Data Tracker) records vaccination uptake by demographic group. Black/African American and Hispanic people have had lower rates of vaccination uptake compared to White people in the United States, although the differences between groups have decreased over time.[10, 11] We would suggest that the data presented from our study show that in a student athlete context, that provides equitable access to basic resources, differences in proportions of vaccination and infection were fairly minimal. This seems to contribute some evidence to the case for improving health equity and increasing fair, equitable access to basic resources like health care, education, nutrition, and secure housing, which might then lead to improved health outcomes across all social demographic categories. This study allows us to better understand some factors related to infections among fully vaccinated individuals and reinfection among student athletes during the Delta variant wave of COVID-19. Several limitations affect the interpretation of results. First, all colleges and universities from the five major conferences were invited to contribute to this study, but not all institutions were able to supply data at the time of invitation. Thus, findings are not representative of all student athletes across these conferences or student athletes in general. Individual case-level data were provided by partners for the January 2021-November 2021 time

period only, and thus cases shown occurred before a booster shot was recommended for the general population. The time period of the data set also reflects COVID-19 infections before the Omicron variant became widespread in the United States.

As mentioned in the Methods section, data on the total aggregate number of student athletes for each participating institution were not available. Additionally, we were not able to collect information on vaccination status for all student athletes for similar reasons. Thus, we were unable to determine total vaccination rates or to calculate attack rate across the entire student athlete population; this also prevented us from studying infection rate by vaccination status. However, through the analyses covered above, we were able to understand some case characteristics among those student athletes testing positive for COVID-19 during this time period.

These data are also limited by variation in the testing policies and protocols of individual institutions. Not all colleges and universities in the sample conducted widespread asymptomatic testing, and thus some schools' positivity percentages might be affected by a broader testing program. Likewise, some schools only tested those student-athletes who were in training or competition as part of in-season sports, and thus seasonality of data collection likely affected the sample of students tested. Finally, only cases with positive COVID-19 tests were included in this study, so we were unable to calculate overall rates of test positivity for the time period.

This paper adds to the knowledge of COVID-19 infections among fully vaccinated individuals in college-aged populations. Additional research that combines data on test positivity and reinfection rates with information on prevention policies and student athlete behavior could help to expand our knowledge of COVID-19 transmission in collegiate athletics and on instutions of higher education campuses in general. The level of infections experienced among student

athletes after full vaccination indicates the need for maintaining precautions to prevent infection, particularly when community transmission rates increase. Further study of COVID-19 vaccination, infection, and reinfection among the well-resourced and diverse population of student athletes might contribute to understanding factors that play a role in health equity among young adults.

## Notes

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**Table 1: Vaccination Status of University Student Athletes in 15 states testing positive for COVID-19 by Demographic Variables, January – November 2021**

| Total Number of Athletes testing positive for COVID-19 | | Not Vaccinated | | Partially Vaccinated | | Fully Vaccinated After COVID-19 Infection | | Fully Vaccinated Before COVID-19 Infection | | Total Fully Vaccinated* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| **Overall** | **1378** | **440** | **31.9%** | **92** | **6.7%** | **538** | **39.0%** | **308** | **22.4%** | **846** | **61.3%** |
| **Sex** | | | | | | | | | | | |
| Female | 577 | 183 | 31.7% | 38 | 6.6% | 216 | 37.4% | 140 | 24.3% | 356 | 61.7% |
| Male | 800 | 257 | 32.1% | 54 | 6.8% | 322 | 40.3% | 167 | 20.9% | 489 | 61.1% |
| Other | 1 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 100.0% | 1 | 100.0% |
| **Sex Total** | 1378 | 440 | | 92 | | 538 | | 308 | | 846 | |
| **Race** | | | | | | | | | | | |
| American Indian | 2 | 2 | 100.0% | | 0.0% | | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Asian American | 24 | 5 | 20.8% | 6 | 25.0% | 9 | 37.5% | 4 | 16.7% | 13 | 54.2% |
| Black/African American | 272 | 75 | 27.6% | 23 | 8.5% | 134 | 49.3% | 40 | 14.7% | 174 | 64.0% |
| White | 702 | 224 | 31.9% | 39 | 5.6% | 271 | 38.6% | 168 | 23.9% | 439 | 62.5% |
| Native Hawaiian/ Pacific Islander | 32 | 7 | 21.9% | 3 | 9.4% | 18 | 56.3% | 4 | 12.5% | 22 | 68.8% |
| Multi-racial | 57 | 12 | 21.1% | 2 | 3.5% | 28 | 49.1% | 15 | 26.3% | 43 | 75.4% |
| Other | 8 | 4 | 50.0% | | 0.0% | 3 | 37.5% | 1 | 12.5% | 4 | 50.0% |
| Unknown | 71 | 19 | 26.8% | 15 | 21.1% | 28 | 39.4% | 9 | 12.7% | 37 | 52.1% |
| **Race Total** | 1168 | 348 | | 88 | | 491 | | 241 | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | | | | | | | | | | | |
| 18 | 75 | 19 | 25.3% | 3 | 4.0% | 20 | 26.7% | 33 | 44.0% | 53 | 70.7 % |
| 19 | 282 | 83 | 29.4% | 21 | 7.4% | 114 | 40.4% | 64 | 22.7% | 178 | 63.1 % |
| 20 | 345 | 91 | 26.4% | 29 | 8.4% | 146 | 42.3% | 79 | 22.9% | 225 | 65.2 % |
| 21 | 295 | 95 | 32.2% | 20 | 6.8% | 118 | 40.0% | 62 | 21.0% | 180 | 61.0 % |
| 22 | 224 | 79 | 35.3% | 14 | 6.3% | 93 | 41.5% | 38 | 17.0% | 131 | 58.5 % |
| 23+ | 135 | 70 | 51.9% | 5 | 3.7% | 43 | 31.9% | 17 | 12.6% | 60 | 44.4 % |
| **Age Total** | 1356 | 437 | | 92 | | 534 | | 293 | | 827 | |
| **Vaccine Type** | | | | | | | | | | | |
| Pfizer | 570 | [redacted] | | 49 | 8.6% | 343 | 60.2% | 178 | 31.2% | 521 | 91.4 % |
| Moderna | 168 | | | 43 | 25.6% | 85 | 50.6% | 40 | 23.8% | 125 | 74.4 % |
| Johnson & Johnson | 200 | | | 0 | 0.0% | 110 | 55.0% | 90 | 45.0% | 200 | 100.0 % |
| **Vaccine Type Total** | 938 | | | 92 | | 538 | | 308 | | 846 | |
| **HHS Region**** | | | | | | | | | | | |
| Region 4 | 227 | 0 | 0.0% | 0 | 0.0% | 74 | 32.6% | 83 | 36.6% | 157 | 69.2 % |
| Region 6 | 167 | 1 | 0.6% | 1 | 0.6% | 57 | 34.1% | 35 | 21.0% | 92 | 55.1 % |
| Regions 7 & 8 | 140 | 3 | 2.1% | 3 | 2.1% | 45 | 32.1% | 20 | 14.3% | 65 | 46.4 % |
| Region 9 | 556 | 82 | 14.7% | 82 | 14.7% | 176 | 31.7% | 154 | 27.7% | 330 | 59.4 % |
| Region 10 | 288 | 6 | 2.1% | 6 | 2.1% | 186 | 64.6% | 16 | 5.6% | 202 | 70.2 % |
| **HHS Region Total** | 1378 | 92 | | 92 | | 538 | | 308 | | 846 | |

*****The Fully Vaccinated Column on the far right of the table shows the sum of the two columns "Fully Vaccinated Before COVID-19 Infection" and "Fully Vaccinated After COVID-19 Infection" for ease of interpreting results in the text.

******HHS Regions each cover a group of states/territories. Regions included here are Region 4 = Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee; Region 6 = Arkansas, Louisiana, New Mexico, Oklahoma, Texas; Region 7 = Iowa, Kansas, Missouri, Nebraska; Region 8 = Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming; Region 9 = Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, Republic of Palau; Region 10 = Alaska, Idaho, Oregon, Washington. Not all states in the region were represented in our sample. Regions 7 and 8 were combined in our analyses due to low sample size.

**Table 2: Cases among University Student Athletes in 15 States Fully Vaccinated Before Infection by Month, January – November 2021**

| Month | Number of Cases Among Student Athletes Fully Vaccinated Before Infection | Percentage of Total Cases among Student Athletes Fully Vaccinated Before Infection |
|---|---|---|
| January | 0 | 0.0% |
| February | 0 | 0.0% |
| March | 1 | 0.3% |
| April | 11 | 3.3% |
| May | 3 | 0.9% |
| June | 8 | 2.4% |
| July | 42 | 12.5% |
| August | 100 | 29.7% |
| September | 102 | 30.3% |
| October | 28 | 8.3% |
| November | 42 | 12.5% |
| **TOTAL** | **337** | **100.0%** |

Note: Numbers of infections among fully vaccinated student athletes are very low in January-March because most student athletes were not eligible for vaccination until April 2021. Numbers of student athletes who were on campus and in active training or competition in May-July were lower overall due to the traditional summer break.