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Arizona and COVID-19: Four-Year Experience 2020-23

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Abstract

It had been four years since COVID-19 first appeared in Arizona on January 22, 2020. The state is about the same size as Italy. Since Arizona Governor Doug Ducey had declared a State of Emergency to combat COVID-19 on March 11, 2020, the state had gone through three Reopening Phases. ABC and NBC News reported that the state had the highest new cases per capital in the world during Arizona's Reopening Phase 2 winter surge in 2020. The state had been in Reopening Phase 3 (final phase) since March 5, 2021. Arizona had the highest death rate per capital of all the 50 states in 2021-22 reported by the Centers for Disease Control and Prevention (CDC).

The study examined four years of the state's COVID-19 pandemic. On December 27, 2023, the four-year totals were 2,540,562 COVID-19 cases, 149,121 hospitalizations, and 33,900 deaths. During the first three years, the case numbers rose (590,745 in 2020, 827,573 in 2021, and 988,649 in 2022), but in the fourth year, the case number had dropped significantly (168,918 in 2023). There were seven case surges during the four years. Arizona had been in the endemic phase of the virus for the past six months. The new normal was not zero cases, but a low number of severe cases, manageable hospitalization numbers, and low number of deaths.

Keywords: COVID-19, Longitudinal Study, Arizona and COVID-19

Introduction

On January 22, 2020, COVID-19 (coronavirus), first appeared in Arizona [1]. The coronavirus is a respiratory disease (attacks primarily the lungs) that spreads from person to person through respiratory droplets (coughs, sneezes, and talks) and contaminated surfaces or objects. It is also known as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). On March 2, 2020, Arizona was one of many states that had the lowest number of COVID-19 cases--2 cases and no hospitalization [2]. Arizona Governor Doug Ducey had declared a State of Emergency to combat COVID-19 on March 11, 2020 [3]. During the past four years, there had been more than 2.5 million cases in the state.

Arizona is the sixth largest in size (113,990 square miles/295,233 square kilometers) of the U.S. 50 states and is about the same size as Italy (301,340 square kilometer) [4,5]. The state population estimate is 7,431,344 on July 1, 2023 [6]. There are total of 2,540,562 COVID-19 cases, 149,121 hospitalizations associated the virus, and 33,900 deaths on December 27, 2023 [7].

There had been three Arizona Reopening Phases. ABC and NBC News reported that the state had the highest new cases per capital in the world during Arizona's Reopening Phase 2 winter surge in 2020 [8,9]. Arizona Governor Douglas Ducey began Reopening Phase 3 (final reopening phase) on March 5, 2021 after the state had administered more than two million vaccine doses and several weeks of declining cases [10,11]. Arizona had the highest death rate per capital of all the 50 states in 2021-22 reported by the Centers for Disease Control and Prevention (CDC) [12,13]. As more people became vaccinated and those infected recovered and had immunity against the virus; the numbers of severe cases, hospitalizations, and deaths would be low; COVID-19 would be manageable; and the state could returned to pre-COVID-19 normal.

After the first year of the pandemic, a three prolong attack against the virus was used--by encouraging the public to practice preventive health behaviors that reduces the risks of getting respiratory infections (e.g., coronavirus, flu, and cold), and using vaccines and therapeutics. Preventive health behaviors included, but were not limited to, practicing physical and social distancing, washing hands frequently and thoroughly, and wearing face masks to reduce exposure to the virus. On October 4, 2023, Arizona Department of Health Services reported that more than 14.3 million vaccine doses

had been administered in the state and Arizona had 4,678,993 fully vaccinated individuals [7].

There was a partnership between the U.S. federal government and each of the 50 states that was needed to address the COVID-19 pandemic [1,14]. The federal government declared a national public health emergency and provided the national guidance primarily through the Centers for Disease Control and Prevention (CDC) and needed logistical support (e.g., provided federal supplemental funding, needed medical personnel and resources, and other needed assistance). President Donald Trump had declared the COVID-19 pandemic as a national emergency on March 13, 2020 [15] and President Joe Biden administration had rescinded it on May 11, 2023 [16].

The states determined what actions to take and when to carry out those actions; the state COVID-19 restrictions; when to carry out each reopening phase; the state vaccination plan; and when the pandemic emergency is over. Arizona Governor Doug Ducey had declared a State of Emergency to combat COVID-19 on March 11, 2020 [3] and ended the COVID-19 Emergency Declaration on March 30, 2022 [17].

The remainder of the paper examined four years of COVID-19 (January 1, 2020 to December 27, 2023) looking at changes in the number of new COVID-19 cases, hospitalizations, deaths and vaccinations given, and what we know about the virus after four years.

Methods

This was a four-year longitudinal study (January 1, 2020 to December 27, 2023). The source of data used was the Arizona Department of Health Services (the state health department) COVID-19 dashboard database. The study examined the changes in the numbers of new COVID-19 cases, hospitalized cases, deaths, and vaccines administered.

There were several data limitations. The COVID-19 case numbers represented the numbers of positive tests reported. When more than one test was given to the same person (e.g., during hospitalization, at work, at school, and mandatory testing), there were individual case duplications. The case numbers did not include the positive home testing results. There were significant number of home testing done in the fourth year. This resulted in the under-reporting of cases in 2023. One could be infected by the virus more than once.

Delays in the data submitted to the state health department affected the timeliness of data reported and caused fluctuations in the number of cases, hospitalizations, deaths, and vaccinations. The case, hospitalization, death, and vaccination statistics did not use the same reporting periods. The state health department continued to adjust the reported numbers that may take more than a month to correct the numbers. The deaths associated with the coronavirus may cause by more than one serious underlying medical conditions and the virus may not be the primary cause of death.

The public reporting period changed during February 2022. It had changed from daily to weekly reporting. The periodic data adjustments made it more difficult to track actual trends. As the result of the World Health Organization and the Biden Administration May 2023 declarations that the COVID-19 global and U.S. public health emergency were over, several agencies/organizations had stopped or limited the public posting COVID-19 statistics. On October 4, 2023, the Arizona Department of Health Services had changed its reporting system and limit the public reported COVID-19 statistics. This made it impossible to report some statistics for the full year 2023 instead October 4 statistics were used for 2023.

Results

A case could be *mild* (no symptoms), *moderate* (sick, but can recover at home), or severe (require hospitalization and/or result in death). Most people recovered and did not require hospitalization. There were seven case surges in the four years: three summers (2020, 2021, and 2022), one fall (2021), and three winters (2020-21, 2021-22, and 2022-23) (Figure 1). The 2022-23 winter case surge was significantly lower than the 2021-22 winter surge. There was no summer or early winter surge in 2023.

At the end of the fourth year, there were total of 2,540,562 COVID-19 cases, 149,121 case hospitalizations, and 33,900 deaths associated with the virus in Arizona (see Table 1). Of the four years examined, 2022 had the highest number of COVID-19 cases, while 2021 had the highest numbers of hospitalizations and deaths. The lowest percentages of hospitalizations and deaths occurred in 2023.

Figure 1: Arizona weekly COVID-19 cases: January 1, 2020 to January 14, 2024.

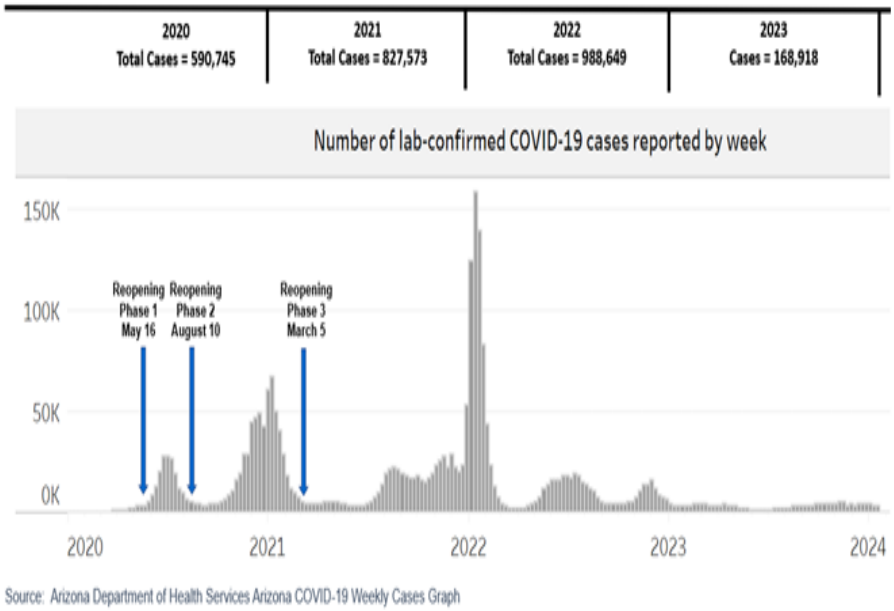


Table 1: Arizona Total Numbers of COVID-19 Cases, Hospitalizations, and Deaths: January 1, 2020 to December 27, 2023.

Time Period	Cases	Hospitalizations	Deaths
January 1 to December 31, 2020	542,653	38,156 (7.03%)	9,075 (1.67%)
January 1 to December 31, 2021	838,835	53,367 (6.36%)	15,224 (1.81%)
January 1 to December 28, 2022	996,846	36,364 (3.65%)	7,883 (0.79%)
January 1 to December 27, 2023	162,228	21,234 (0.13%)	1,718 (0.01%)
Jan. 1, 2020 to Dec. 27, 2023	2,540,562	149,121	33,900

Source: Arizona Department of Health Services COVID-19 Dash board.
Arizona 2020 population is 7,151,502, April 1, 2020, Arizona 2021 population estimate is 7,276,316, July 1, 2021, Arizona 2022 population estimate is 7,359,197, July 1, 2022, and Arizona 2023 population estimate is 7,431,344, July 1, 2023–U.S. Census.

Tables 2 tracks the weekly total and weekly numbers of COVID-19 cases, hospitalized cases, and deaths for the last two months in 2023. The highest number of cases and hospitalizations occurred during the week of December 6, 2023, while the week of December 13 had the highest number of deaths.

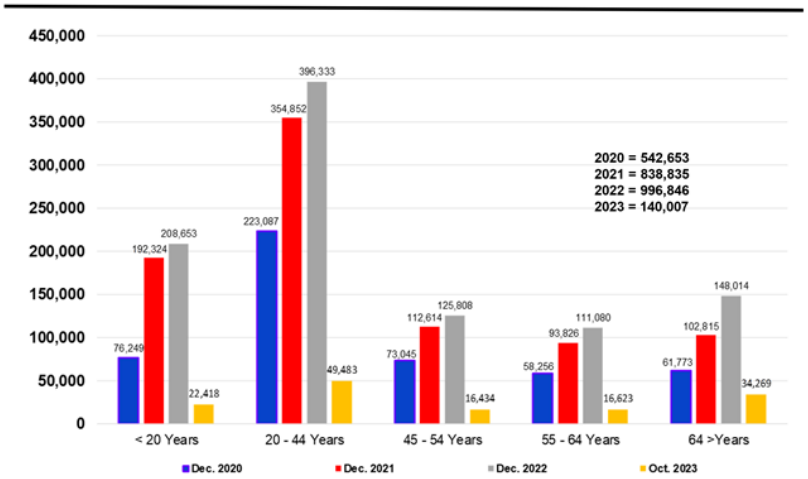
Table 2: Arizona Total and Weekly Numbers of COVID-19 Cases, Hospitalizations, and Deaths.

Date	Total Cases	Weekly Case	Total Hospital	Weekly Hospital	Total Deaths	Weekly Deaths
11-01-2023	127,374	4,260	16,259	641	1,456	36
11-08-2023	131,783	4,409	16,801	542	1,476	20
11-15-2023	136,949	5,166	17,503	702	1,511	35
11-22-2023	142,315	5,366	18,276	773	1,545	34
11-29-2023	145,817	3,502	18,766	490	1,565	20
12-06-2023	151,701	5,884	19,600	834	1,599	34
12-13-2023	155,188	3,487	20,098	498	1,649	50
12-20-2023	159,220	4,032	20,771	673	1,692	43
12-27-2023	162,228	3,008	21,234	463	1,718	26

Source: Arizona Department of Health Services COVID-19 Dash board.
Arizona 2023 population estimate is 7,431,344, July 1, 2023– U.S. Census

The numbers of cases for five age groups in the four years are shown in Figure 2. The 20-44 age group had the largest number of cases. There were more females (53%) than males (47%) who got the virus. The two largest state race/ethnicity groups diagnosed with COVID-19 were White, non-Hispanics (39%) and Hispanics (28%) as of October 4, 2023.

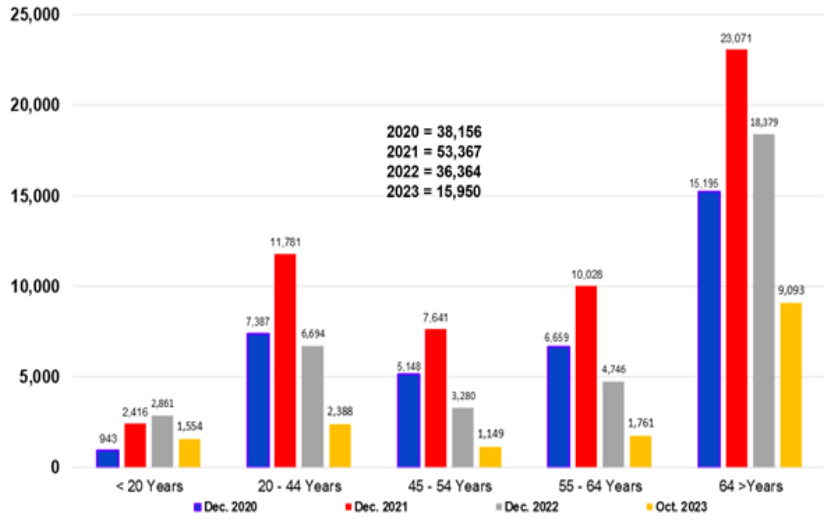
Figure 2: Arizona COVID-19 cases by age groups for 2020-2023.



Source: Arizona Department of Health Services COVID-19 Cases by Age Groups Statistics.
The yearly totals for 2020 and 2021 reported on Dec. 26, for 2022 reported on Dec. 28, and for 2023 reported on Oct. 4.

The hospitalization numbers for each age group in the four years are shown in Figure 3. As expected, those under 20 years of age had the lowest percentage of total hospitalization (5.4%), while seniors had the highest percentage (46.0%) on October 4, 2023. One and six tenth percent of those under 20 years of age diagnosed with COVID-19 were hospitalized, while 18.9 percent of senior were hospitalized. There were more males (51.3%) than females (48.7%) who were hospitalized.

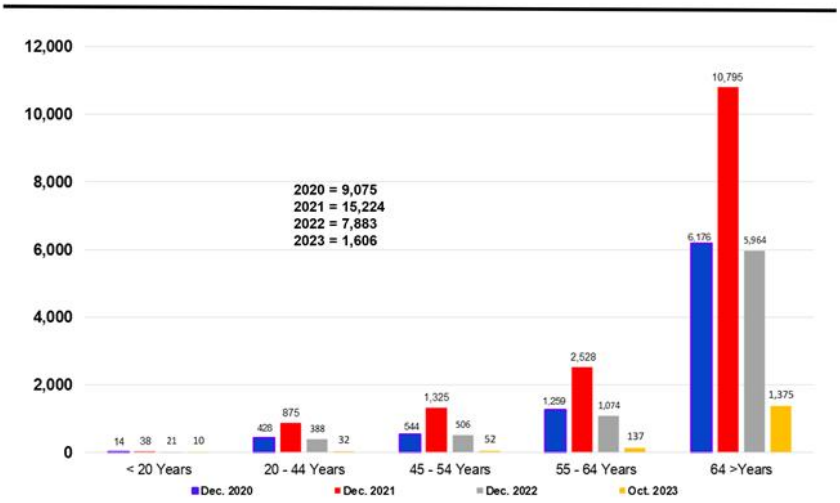
Figure 3: Arizona COVID-19 cases by hospitalizations by age group for 2020-2023.



Source: Arizona Department of Health Services COVID-19 Case Hospitalizations by Age Groups Statistics.
The yearly totals for 2020 and 2021 reported on Dec. 26, for 2022 reported on Dec. 28, and for 2023 reported on Oct.4.

Those under 20 years of age had the lowest percentage of total deaths (0.2%) and seniors had the highest percentage (72.4%) on October 4, 2023. Seven percent of the seniors diagnosed with COVID-19 died, while 0.016 percent of those under 20 years of age died. There were more males (58%) than females (42%) who died. The death numbers for each age group in the four years are shown in Figure 4.

Figure 4: Arizona COVID-19 deaths by age groups for 2020-2023.



Source: Arizona Department of Health Services COVID -19 Deaths by Age Groups Statistics
The yearly totals for 2020 and 2021 reported on Dec. 26, for 2022 reported on Dec. 28, and 2023 reported on Oct. 4.

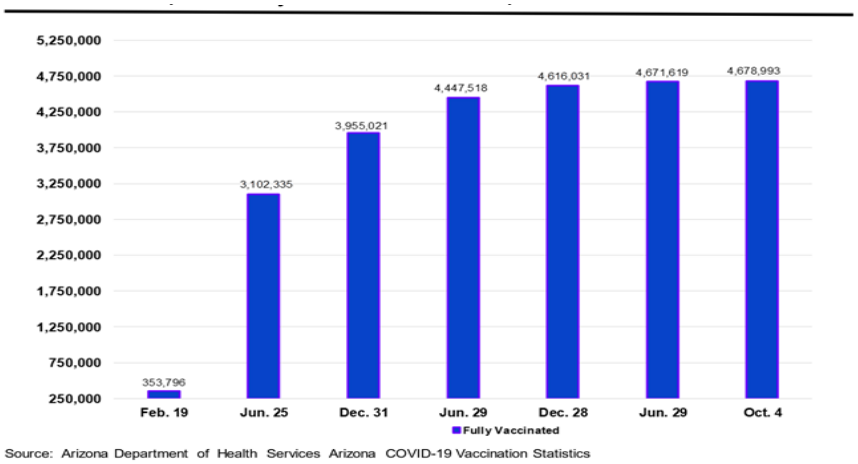
On December 11, 2020, the first U.S. COVID-19 vaccine, Pfizer/BioNTech Comirnaty, was approved for use by the Food and Drug Administration (FDA) for emergency authorization use [1]. Arizona began to administer vaccines in late December. There were three vaccines (Pfizer/BioNTech Comirnaty, Moderna Spikevax, and Johnson & Johnson Jcovden) available in 2021. The fourth vaccine, Novavax Nuvaxivud, was approved in July 2022. The vaccines provided different levels of protection against COVID-19 and its variants.

The first booster was Comirnaty approved in September 2021. Soon after, Spikevax booster became available. The latest booster approved was Nuvaxivud (October 2022). In August 2022, the FDA approved the new Pfizer/BioNTech and Moderna bivalent COVID-19 vaccines that include both the original virus and the Omicron BA.4 and BA.5. It was used as another vaccine booster. The FDA approved three 2023-24 monovalent vaccines (Omicron variant XBB.1.5) in September and October 2023.

On January 8, 2021, the Arizona Department of Health Services reported 126,090 vaccine doses were administered and 124,322 who were partial protected against COVID-19. This had grown to 14,370,914 vaccine doses were administered and 4,678,993 who were fully vaccinated against the virus (October 4, 2023). Figure 5 shows the numbers of persons who were fully vaccinated from February 19, 2021 to October 4, 2023. In the fourth year, the number of fully vaccinated persons had plateaued

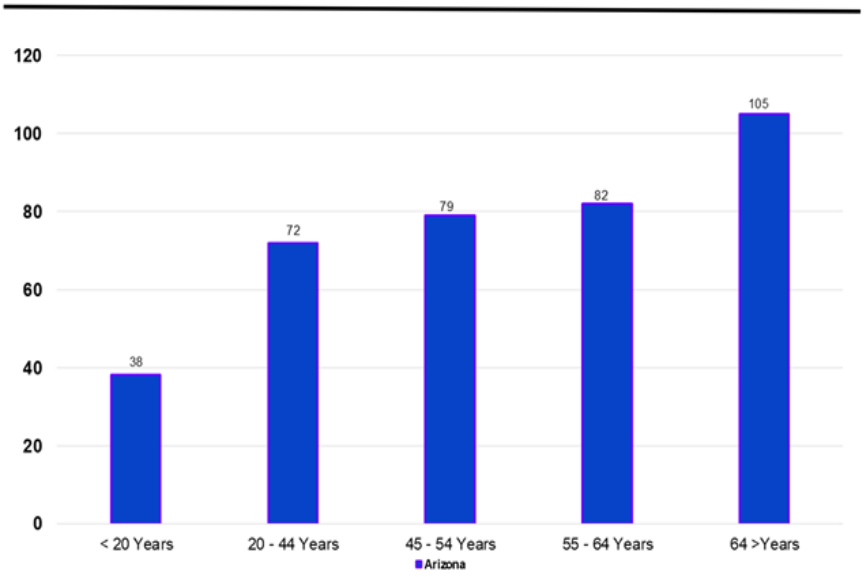
Those 65 years and older had the highest vaccination percentage, while those under 20 years of age had the lowest on October 4, 2023 (see Figure 6).

Figure 5: Arizona COVID-19 fully vaccination numbers: February 19, 2021 to October 04, 2023.



Source: Arizona Department of Health Services Arizona COVID-19 Vaccination Statistics

Figure 6: Arizona COVID-19 vaccination percentages (at least one shot) by age groups on October 04, 2023.



Source: Arizona Department of Health Services COVID -19 Vaccinations by Age Group Statistics:

Discussion

It had been four years since COVID-19 first appeared in Arizona on January 22, 2020 [1]. There were 2,540,562 COVID-19 total cases, 149,121 hospitalizations, and 33,900 deaths on December 27, 2023. During the first three years, the case numbers rose (590,745 in 2020, 827,573 in 2021, and 988,649 in 2022), but in the fourth year, the case number had dropped significantly (168,918 in 2023). There were seven case surges during the four years, but no surges in summer 2023 and the beginning of winter 2023-24. The state had moved from the pandemic phase to the endemic phase.

On March 11, 2020, Arizona Governor Doug Ducey had declared a State of Emergency to combat COVID-19 [3]. In the first year, the primary 2020 strategies used to confront the virus, without the availability of vaccines and therapeutics, were to encourages the public to practice preventive health behaviors that reduces the risks of getting respiratory infections and stay-at-home. For those who have or have been exposed to the coronavirus had to be quarantined. Governor Ducey issued a Stay-at-Home Executive Order on March 30, 2020 [2]. His stay at home policy and practicing preventive health behaviors kept the cases low that allowed the state to build up its healthcare resources. Reopening Phase 1 began on May 15, 2020 [2].

After the first year, (2021-23), a three-pronged attack was used against the virus: (1) encourage preventive health behaviors, (2) increase vaccination numbers, and (3) use therapeutics. On December 11, 2020, the first U.S. COVID-19 vaccine was approved by FDA for emergency authorization use [1]. As more people were vaccinated and those infected recovered and had immunity against the virus; the numbers of severe cases, hospitalizations, and deaths would be low; COVID-19 would be manageable; and the state could be able to return to pre-COVID-19 normal [11]. The first anti-viral treatment (Remdesivir) was approved by the FDA for emergency authorization use on October 22, 2020 [1]. Reopening Phase 2 began on August 10, 2020 [2,10].

After the state had administered more than two million vaccine doses and several weeks of declining cases, the Arizona Governor began Reopening Phase 3 (final phase) on March 5, 2021 [10,11]. The state continued its efforts to vaccinate its population, and the vaccination numbers continued to rise. Arizona Governor Ducey ended the COVID-19 Emergency Declaration on March 30, 2022 [17]. During the four years, the highest numbers of fully vaccinated persons occurred in the week of April 17 to 23, 2021 (249,755) [11]. Soon after, the pace of vaccination had slowdown.

Overtime, the early vaccines became less effective against the later Delta and Omicron variants comparing to the original Alpha. There were breakthrough infections and vaccines waned over time. Those whose vaccine protection were waning received booster vaccines to extend their immunity protection. Even though the vaccines and boosters reduced the risks in getting a severe case, one could still get the virus. After the FDA approved Pfizer/BioNTech Comirnaty 2023-24 new monovalent vaccine (Omicron variant XBB.1.5) on September 11, 2023, the previous COVID-19 vaccines were no longer used. Those therapeutics that became less effective against the new variants (e.g., the monoclonal antibodies) were also discontinued.

There were signs of the public experiencing COVID-19 fatigue (e.g., significant numbers did not wear masks during the 2022 summer and fall case surges and paid little attention to the daily/weekly number of case increases) [14]. Many felt that the pandemic was over. The World Health Organization declared the COVID-19 global public health emergency was over on May 5, 2023 [17]. Shortly after, the Biden Administration declared the COVID-19 public health emergency was over in the United States on May

11, 2023 [16]. Both declarations reinforced the perception that the pandemic was over.

There were more COVID-19 vaccination hesitation in 2022 and 2023 than in 2021. The number fully vaccinated person had plateaued in the fourth year. The overall vaccination rates had declined as well as interest in getting the COVID-19 boosters.

Many still had stress/anxiety/depression associated with the virus. The causes for the mental anguish were the uncertainty of the virus, constant emergent of new variants, vaccine limitations, the lack control of the situation, and no end to the virus. There were persons who had not adapted to the new normal and had limited their interactions with people in 2023.

The Arizona COVID-19 population exhibited several characteristics. Those who had highest risk of acquiring COVID-19 were those immune compromised, who had severe medical conditions, adult 65 and older, and those who were obese. The age group that had the highest number of cases were those adults 20-44 years. As expected, those 65 and older had the highest numbers of case hospitalizations and deaths, while those who are under 20 years of age had the lowest numbers of case hospitalizations and deaths. Women had a higher percentage of cases than men, but men had higher percentage of hospitalizations and deaths than women. As the age group gets older, the COVID-19 vaccination rate increased. The seniors had the highest vaccination rate.

In 2023, the state COVID-19 case, hospitalization, and death numbers had been low with occasional weekly fluctuations. There were no summer and early winter surges like the previous three years. Going into the fifth year of COVID-19 the case number remains low. This may not be the case for other U.S. states.

Conclusion

Since the middle of the fourth year, COVID-19 have been in its endemic phase–the virus continues to mutate, multiply, spread, and infect the Arizona population, but the case number has been low. After four years, most Arizonan have decided what to do about COVID-19 (e.g., when to practice COVID-19 preventive health behaviors and how often, whether to get the most updated vaccine, and how to adapt to the new normal). The new normal is not zero case, but low numbers of severe cases and deaths, and manageable hospitalization numbers.

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