

Arizona and COVID-19: Lessons Learned After 30 Months

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Abstract

It had been more than 30 months since COVID-19 appeared in the world. On January 22, 2020, the first case recorded in Arizona. 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 has been in Reopening Phase 3 since March 5, 2021. Arizona is about the same size as Italy and the sixth largest in size of the United States 50 states. The study examined 30 months of the state's COVID-19 pandemic. At the end of the two and half years, there were 2,125,567 COVID-19 cases, 111,903 hospitalizations, 30,515 deaths, and 12,004,865 vaccine doses administered (June 29, 2022). The case numbers of hospitalization percentages had declined in each of the three-years. During the past 18 months, the death rates declined. The lessons learned included: who had the highest risk in getting the virus, the vaccine limitations, men had a higher risk for getting a severe case than women, there were cyclic case surges, and normal was not zero cases.

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

Introduction

COVID-19 (coronavirus) is a respiratory disease (attacks primarily the lungs) that spreads by person to person through respiratory droplets (coughs, sneezes, and talks) and contaminated surfaces or objects. It is also known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus first appears in Wuhan, China in December 2019. Johns Hopkins University [1] reports that there are 546,390,185 total cases and 6,334,351 deaths associated with the virus in the world on June 29, 2022. The United States (U.S.) has the highest total cases (87,410,874) and deaths (1,017,467) in the world [1].

A three prolong attack is used against the virus by encouraging the public to practice health behaviors that reduces the risks of getting respiratory infections (e.g., coronavirus, flu, and cold), and using vaccines and therapeutics. The preventive health behaviors include, but not limited to, practicing physical and social distancing, washing hands frequently and thoroughly, and wearing face masks. Johns Hopkins reports that more than 11.73 billion vaccine doses have been administered in the world and the U.S. has administered more than 591 million vaccine doses (June 29, 2022) [1].

Arizona is the sixth largest in size of the U.S. 50 states (113,990 square miles/295,233 square kilometers) and is about the same size as Italy (301,340 square kilometer) [2,3]. The state population estimate is 7,276,316 (July 1, 2021) [4]. The first Arizona case recorded was on January 22, 2020. At the end of 30 months, Arizona

is ranked 13th in total COVID-19 cases (2,109,053) and 11th in total deaths (30,452) of the 50 U.S. states [1]. There has been three Arizona Reopening Phases. During Arizona's Reopening Phase 2 winter surge in 2020, ABC and NBC News report that the state has the highest new cases per capital in the world [5,6]. The state has been in Reopening Phase 3 since March 5, 2021.

A partnership between the U.S. federal government and each of the 50 states is required to address the COVID-19 pandemic [7]. The federal government provides the national guidance primarily through the Centers for Disease Control and Prevention (CDC) and needed logistical support (e.g., provide federal supplemental funding, needed medical personnel and resources, and other needed assistance). The states decide on what actions to take and when to carry out those actions; the state COVID-19 restrictions; and when to carry out each reopening phase; and the state vaccination plan.

As more people become vaccinated and those infected recovered and have immunity against the virus; the numbers of cases, hospitalizations, and deaths will be low; COVID-19 will be manageable; and the state will be able to return to normal. Therapeutics have also kept the numbers of hospitalizations and deaths low.

The study examines two and half years of the COVID-19 pandemic (January 1, 2020 to June 29, 2022) looking at changes in the state number new COVID-19 cases, hospitalizations, and deaths as well as lessons learned during the 30 months.

Methods

This is a 30-months longitudinal study. It examines the changes in the numbers of new COVID-19 cases, hospitalized cases, deaths, and vaccines given and lessons learned. The data source for the study is from the Arizona Department of Health Services (the state health department) COVID-19 dashboard database.

There are several data limitations. The COVID-19 case numbers represent the numbers of positive tests reported. When more than one test given to the same person (e.g., during hospitalization, at work, and mandatory testing), there are individual case duplications. Aggressive testing results in increases in false positive and false negative testing results. There are delays in the data submitted daily to the state health department that affected the timeliness of data reported and caused fluctuations in the number of cases, hospitalizations, deaths, and vaccinations. The state

health department continues to adjust the reported numbers that may take more than a month to correct the numbers. The deaths associate with the coronavirus may be caused by more than one serious underlying medical conditions, and the virus may not be the primary cause of death.

Results

At the end of 30-months of the COVID-19 pandemic (June 29, 2022), there were 2,125,567 COVID-19 cases, 111,903 case hospitalizations, 30,515 deaths associated with the virus, and 12,004,865 vaccine doses administered in Arizona (Table 1). The three-year case hospitalization percentages declined (2020-7.03%, 2021-6.36%, and 2022-2.74%). The past 18-month death percentages (first half 2021-2.52%, second half 2021-1.30%, and first half 2022-0.85%) had declined.

Table 1: Arizona Total Numbers of COVID-19 Cases, Hospitalizations, Deaths, and Vaccine. Administered: January 1, 2020 to June 29, 2022.

Time Period	Cases	Hospitalizations	Deaths	Vaccinations
January 1 to June 30, 2020	79,894	4,989(6.24%)	1,653(2.07%)	NA
July 1 to December 31, 2020	462,759	33,167(7.17%)	7,422(1.60%)	95,160
January 1 to December 31, 2020	542,653	38,156(7.03%)	9,075(1.67%)	95,160
January 1 to June 30, 2021	352,323	27,477(7.80%)	8,874(2.52%)	6,356,233
July 1 to December 31, 2021	486,512	25,890(5.32%)	6,350(1.30%)	3,375,453
January 1 to December 31, 2021	838,835	53,367(6.36%)	15,224(1.81%)	9,731,686
January 1 to June 29, 2022	744,079	20,380 (2.74%)	6,286 (0.85%)	2,178,019
January 1, 2020 to June 29, 2022	2,125,567	111,903	30,515	12,004,865

Source: Arizona Department of Health Services COVID-19 Dashboard. Arizona 2020 population is 7,151,502, April 1, 2020 and Arizona 2021 population estimate is 7,276,316, July 1, 2021-U.S. Census.

Tables 2 tracks the weekly total and weekly numbers of COVID-19 cases, hospitalized cases, and deaths for the past three months in 2022. The case hospitalization and death numbers were low.

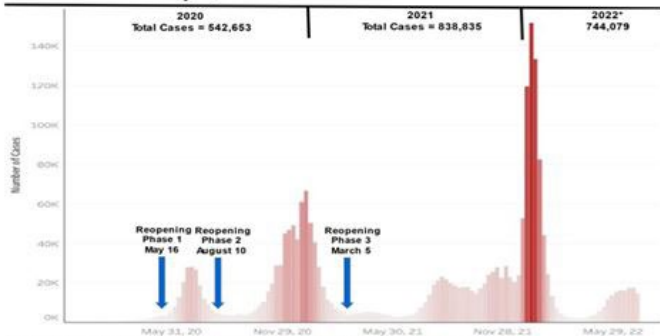
Table 2: Arizona Total and Weekly Numbers of COVID-19 Cases, Hospitalizations, and Deaths.

Date	Total Cases	Weekly Case	Total Hospital	Weekly Hospital	Total Deaths	Weekly Deaths
04-06-2022	2,014,020	6,840	108,953	185	29,681	413
04-13-2022	2,016,797	2,777	109,050	97	29,823	142
04-20-2022	2,019,174	2,377	109,262	212	29,852	29
04-27-2022	2,021,524	2,350	109,443	181	29,951	99
05-04-2022	2,025,435	3,911	109,539	96	30,189	238
05-11-2022	2,030,925	5,490	109,656	117	30,230	41
05-18-2022	2,038,129	7,204	109,820	164	30,259	29
05-25-2022	2,049,627	11,498	110,029	209	30,299	40
06-01-2022	2,062,669	13,042	110,202	173	30,332	33
06-08-2022	2,077,346	14,677	110,587	385	30,372	40
06-15-2022	2,093,680	16,334	110,871	284	30,400	28
06-22-2022	2,109,053	15,373	111,410	539	30,452	52
06-29-2022	2,125,567	16,514	111,903	493	30,515	63

Source: Arizona Department of Health Services COVID-19 Dashboard. Arizona 2021 population estimate is 7,285,370, July 1, 2021-Arizona OEO.

A case could be mild (no symptoms), moderate (sick, but can recover at home), and severe (require hospitalization and/or result in death). Most people recovered and did not require hospitalization. There were six case surges during the two- and half-year period: three summers, one fall, and two winters (Figure 1). Unlike 2020 summer and winter surges, there was no significant decline in cases during the 2021 summer, fall, and winter surges. The 2021-22 winter surge peak was twice as high as 2020-21 winter.

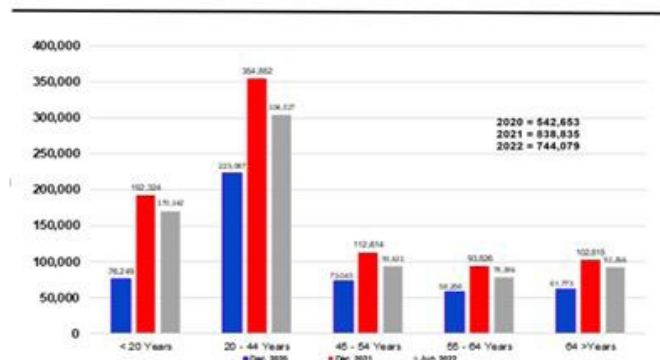
Figure 1: Arizona weekly COVID-19 cases: January 1, 2020 to July 3, 2022.



Source: Arizona Department of Health Services Arizona COVID-19 Weekly Cases Graph * 2022 cases as of June 29

Figure 2 shows the number of cases for five age groups. The two age groups that had the largest case increases were 20-44 years and younger than 20 years. 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 (40%) and Hispanics (29%).

Figure 2: Arizona COVID-19 cases by age groups for 2020, 2021, and 2022.

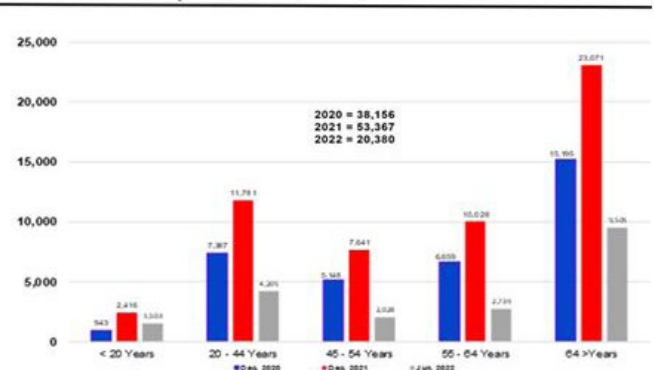


Source: Arizona Department of Health Services COVID-19 Cases by Age Groups Statistics The yearly totals reported on December 26, 2020 and 2021. The half year for 2022 reported on June 29, 2022.

As expected, seniors had the highest percentage of the total hospitalizations (43.1%) and those under 20 years of age had the lowest percentage (4.4%) on June 29, 2022. Nineteen percent (18.6%) of seniors diagnosed with COVID-19 were hospitalized, while 1.1 percent of those under 20 years of age were hospitalized. There were more males (52.3%) than females (47.7%) who were

hospitalized. The 30-month case hospitalization percentages had been declining. Figure 3 shows the hospitalization numbers for each age group in 2020, 2021, and 2022.

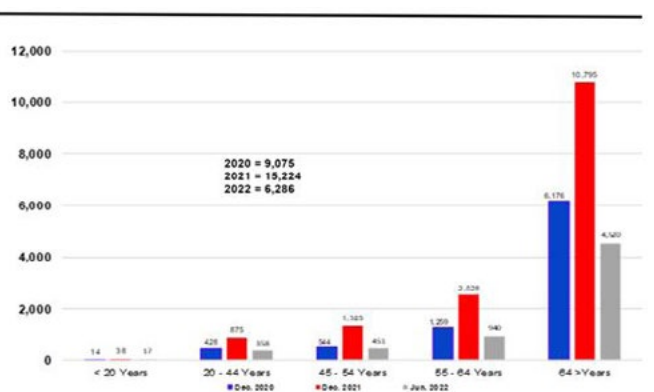
Figure 3: Arizona COVID-19 cases hospitalizations by age groups for 2020, 2021, and 2022.



Source: Arizona Department of Health Services COVID-19 Hospitalizations by Age Groups Statistics The yearly totals reported on December 26, 2020 and 2021. The half year for 2022 reported on June 29, 2022.

Seniors had the highest percentage of total deaths (71.0%) and those under 20 years of age had the lowest percentage (0.2%) on June 29, 2022. Eight percent (8.3%) of the seniors diagnosed with COVID-19 died, while 0.016 percent of those under 20 years of age died. There were more males (59%) than females (41%) who died. The rate of fatalities per 100,000 population was 424.5. The death percentages had declined. Figure 4 shows the death numbers for each age group in 2020, 2021, and 2022.

Figure 4: Arizona COVID-19 deaths by age groups for 2020, 2021, and 2022.

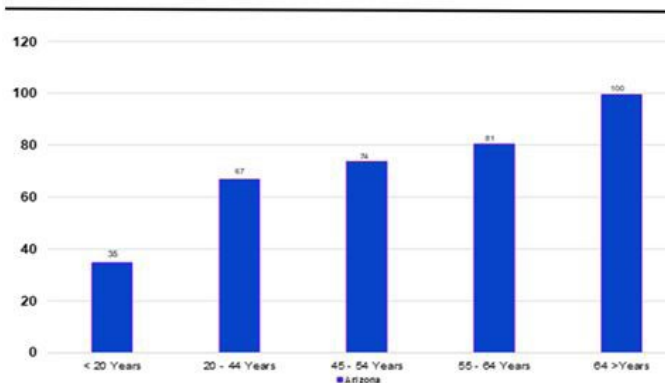


Source: Arizona Department of Health Services COVID-19 Deaths by Age Groups Statistics The yearly totals reported on December 26, 2020 and 2021. The half year for 2022 reported on June 29, 2022.

On December 11, 2020, the first U.S. COVID-19 vaccine, Pfizer/BioNTech Comirnaty, was approved for use. Arizona began to administer vaccines in late December. Three vaccines were available (Pfizer/BioNTech Comirnaty, Moderna Spikevax, and Johnson & Johnson Jcovden). The vaccines provided different levels of protection against COVID-19 and variants.

The Arizona Department of Health Services reported 126,090 vaccine doses were administered and 124,322 who were partial protected against COVID-19 on January 8, 2021. This had grown to 12,004,865 vaccine doses were administered and 4,447,518 who were fully vaccinated against the virus (June 29, 2022). Those 65 years and older had the highest vaccination percentage, while those under 20 years of age had the lowest (Figure 5). It is expected the vaccination rates for this age group will increase with the approval of younger children vaccines use.

Figure 5: Arizona COVID-19 vaccination percentages (at least one shot) by age groups on June 29, 2022.



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

Discussion

At the beginning of the COVID-19 pandemic, very little was known about the virus and there were limited healthcare resources available. There was no approved U.S. drug to treat the virus or vaccine during most of the first year (2020). It was not until October 22, 2020 that the first drug, Remdesivir (Veklury) was approved for the treatment of COVID-19 and on December 11, the first U.S. vaccine Comirnaty was approved by the Food and Drug Administration (FDA).

Without vaccines and therapeutics, the primary strategies in 2020 to confront the virus were to encourage the public to practice preventive health behaviors that reduces the risks of getting respiratory infections (e.g., coronavirus, flu, and cold) and stay-at-home. For those who have or have been exposed to the virus had to be quarantined. Arizona Governor Douglas Ducey stay at home policy and practicing preventive health behaviors were effective in flatten the curve kept the cases low that allow the state to build up its healthcare resources.

Since the first year, it was known that those who have highest risk of acquiring COVID-19 were those immune compromised, who had severe medical conditions, adult 65 and older, and those who were obese.

At the end of December 2020, Arizona began to administer the COVID-19 vaccines. On March 5, 2021, the Arizona Governor

began Reopening Phase 3 after the state had administered more than two million vaccine doses and several weeks of declining cases [8]. The state continued its efforts to vaccinate its population. The highest numbers of fully vaccinated persons occurred during the week of April 17 to 23 (249,755) [9]. Soon after, the pace of vaccination had slowdown in June.

In the second and third years (2021-22), Arizona used a three-pronged attack against the virus: (1) encourage preventive health behaviors, (2) increase vaccination numbers, and (3) use therapeutics. Those who have the highest risks of getting the virus were given the highest priority in receiving the vaccines. As more people were vaccinated and those infected recovered and have immunity against the virus; the numbers of cases, hospitalizations, and deaths would be low; COVID-19 would be manageable; and the state would be able to return to normal [10].

During the month of July 2021, the highly contagious Delta variant appeared in the state and began the summer surge. Even with the increase vaccination efforts and other actions, they were not enough to stop the Delta variant. This resulted in the fall surge. In December, the more contagious Omicron variant appeared in the state and began to surge. The Omicron variant surge in January 2022, and the cases remained high into early March. For more than two months in the spring, the cases were low. The state cases rose at the end May as the Omicron variants moved westward in the U.S. The CDC reported that two-thirds of Arizona was at high COVID-19 transmission risk and the remainder of the state was at medium transmission risk on June 30, 2022.

Overtime, the vaccines were not as effective against the later variants (Delta and Omicron) and Omicron subvariants as the original Alpha. There were breakthrough infections, and vaccines waned over time. Those whose vaccine protection were waning needed to get booster shots to extend their immunity protection. The vaccines and their boosters reduced the risks in getting a severe case, but one could still get the virus.

There are new vaccines being developed to address these issues. Both Pfizer and Moderna have new COVID-19 vaccines (effective against Omicron and other variants) in Phase 3 Clinical Trials. On July 13, 2022, the fourth U.S. vaccine Novavax Nuvaxivud has been approved by the Food and Drug Administration for use.

The Arizona COVID-19 population had several characteristics. Those 20-44 years of age group had the highest number of cases. The next age group with highest number of cases was those under 20 years of age. The Omicron case numbers increased significantly in this age group. As expected, those who are under 20 years of age had the lowest numbers of case hospitalizations and deaths, while those 65 and older had the highest 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.

The three vaccines and therapeutics kept the number of hospitalizations and deaths low. Even with the occasional case surges, the state normal were low number of severe cases, manageable hospitalization numbers, and very low number of deaths.

Conclusion

During the 30 months of the COVID-19 pandemic, the lessons learned include: who have the highest risk in getting the virus, limitations of the vaccines, men have a higher risk for getting a severe case than women, there are cyclic case surges, and normal is not zero cases. The numbers of severe COVID-19 cases and deaths in Arizona have been low because of the high level of population immunity and the availability of drugs for treating the virus.

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