

Covid-19 Disease Outbreak Outlook

Arizona State and Pima County

Updated June 19, 2020

Disclaimer: This information represents my personal views and not those of The University of Arizona, the Zuckerman College of Public Health, or any other government entity. Any opinions, forecasts, or recommendations should be considered in conjunction with other corroborating and conflicting data.

For the week ending Sunday, June 14th, 11862 new Covid-19 cases were reported in Arizona (Figure 1). Last week's update reported 7286 new cases for the week ending June 7th, but that count has since been revised to 7990 cases. This week's 10% "backfill" is somewhat larger than last week's 8% indicating that reporting lag is about the same or slightly longer.

Once again, PCR testing is increasing making it difficult to draw conclusions about the underlying dynamics of viral transmission. Nevertheless, since the testing blitz ended the week of May 17, weekly case counts have increased faster than testing, 284% (3086 to 11862) versus 67% (45488 to 72985), respectively. This differential supports the notion that community transmission is increasing.

At least 72985 individuals provided 89310 PCR samples this past week of which 13.3% were positive which is higher than last week's value of 11.1%; 15611 individuals provided 27248 serology samples of which 3.8% were positive (Figure 2 following page). Since the week ending May 17th, the percent of PCR specimens that are positive has increased from 5.3% to 13.3% providing additional evidence that testing capacity is not keeping pace with community transmission. The percent of serology specimens that are positive has increased from 2.9% to 3.8% over the same time indicating a growing, but still small, pool of recovered individuals. Note: Test positive values may vary slightly from the ADHS Dashboard owing to several data reporting challenges.

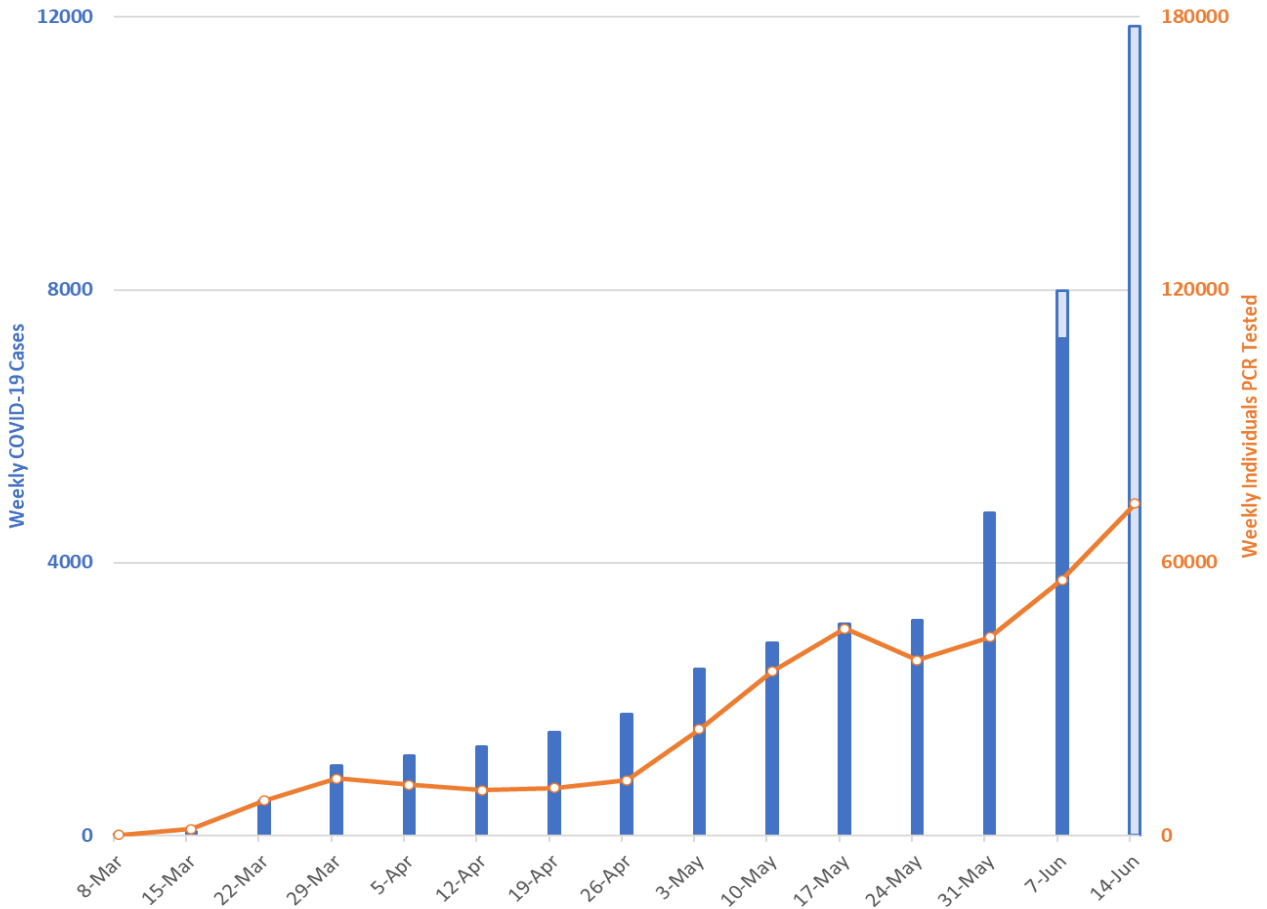


Figure 1. Newly Diagnosed Covid-19 Cases in Arizona and Number of Individuals Tested through June 14

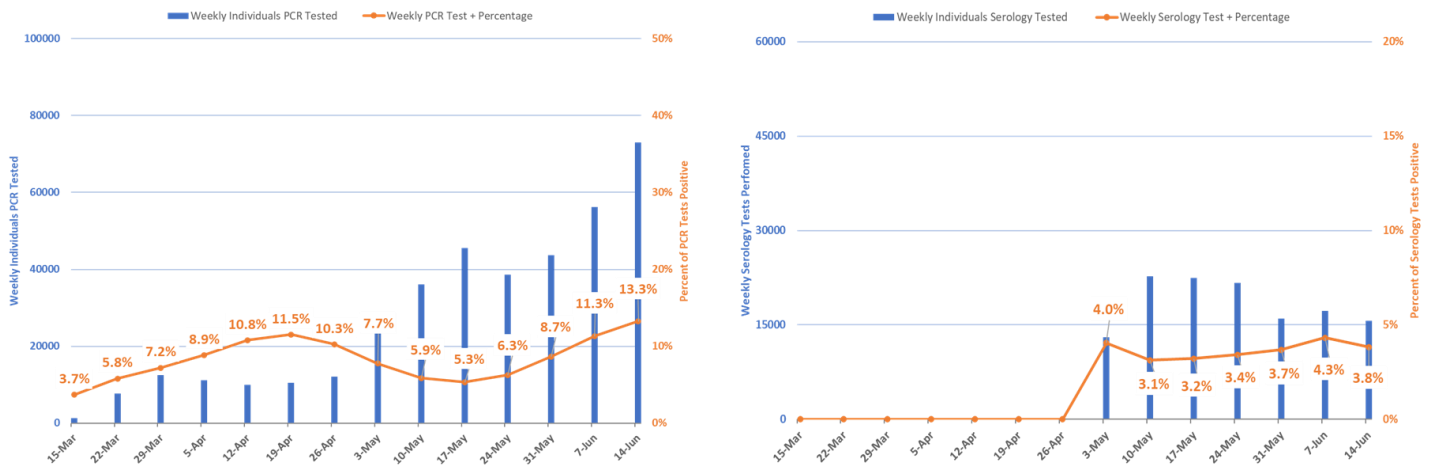


Figure 2. Patients Tested and Percent Specimens Positive for Covid-19 PCT and Serology Mar 15 - June 14.

The 7-day moving average of doubling time for cumulative Covid-19 cases has shortened from a peak of 29 days on May 25th to 16 days on June 14th (Figure 3). The 7-day moving average of doubling time for cumulative deaths has continued to lengthen reaching a high-water mark of 48 days on June 7th. A longer offset (e.g., June 7th versus 14th) is needed because of longer reporting delays for deaths.

As evidenced by a widening gap in doubling times beginning April 27, the testing blitz impacted trends in doubling times for reported cases but not deaths. This is the expected outcome if testing merely identifies individuals with milder disease who would have otherwise remained undetected. Because there is a 14-day interval between PCR diagnosis and death and the reporting delays for deaths is about a week longer than for new cases, it is still too early to know to how the recent increase in cases impacted mortality trends. If these new cases reflect increased community transmission among similar populations, then mortality trends would be expected to increase soon.

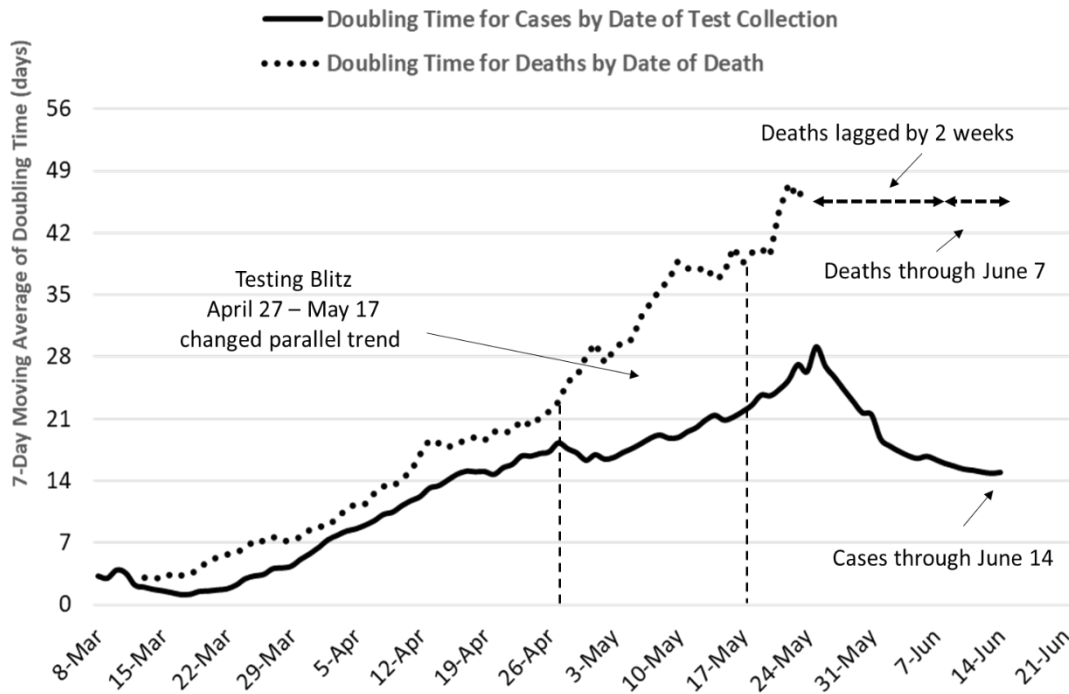


Figure 3. 7-Day Moving Average of Doubling Time of Cumulative Cases through June 14 Superimposed on Lagged (2-week) Doubling Time of Cumulative Deaths through June 7.

From a May 22 (plateau) to present (June 19), Covid-19 total hospitalization has increased 127% from 1093 to 2484 occupied beds (Figure 4). Increases in Covid-19 general ward occupancy were greater than increases in ICU occupancy, 147% and 77%, respectively. Because of a decline in non-Covid hospitalizations, the all-cause hospital census has only increased 12% from 7173 to 8003 occupied beds (not shown). Continued increases in case counts are expected to drive additional hospitalizations for the foreseeable future.

As of June 19, 1938 (24.7%) of Arizona’s 7836 general ward beds were occupied by patients with suspected or confirmed Covid-19 infection, a 37% increase from last week. An additional 1238 (15.8%) beds remain available which is the same number as last week. Similarly, 546 (32.9%) of Arizona’s 1662 ICU beds were occupied for Covid-19 care, a 22% increase from last week. An additional 257 (15.5%) beds remain available which is lower than the 347 available last week.

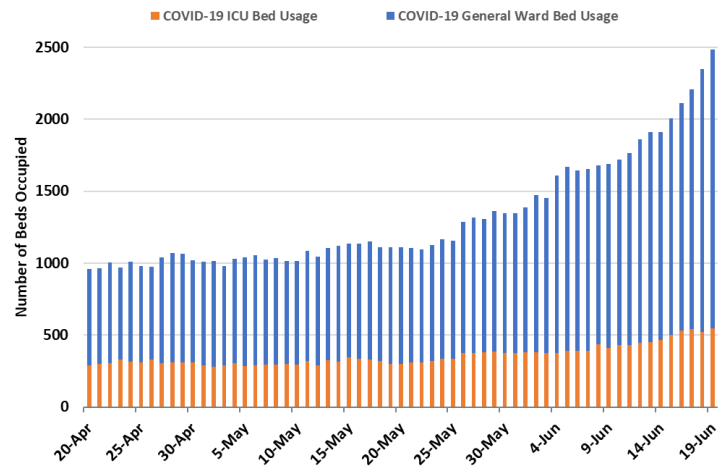


Figure 4. Arizona Daily Covid-19 General Ward and ICU Census April 20 – June 19.

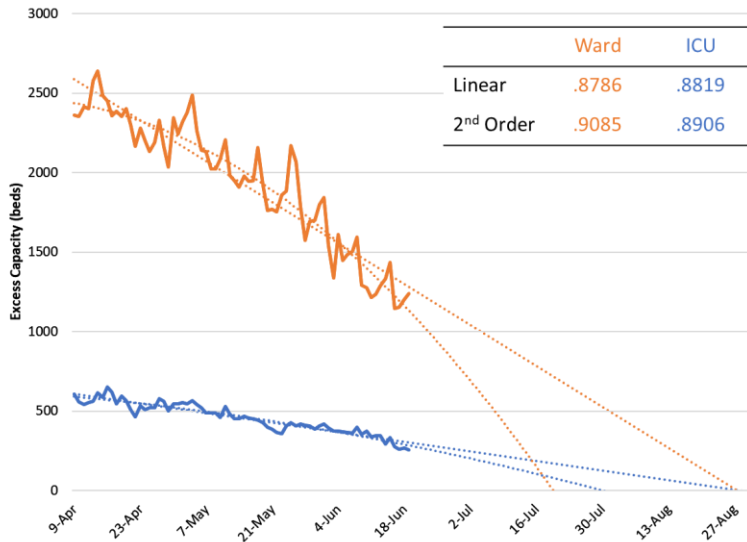


Figure 5. Observed and Projected Excess Non-Surge General Ward and ICU Capacity April 20 – August 31.

As mentioned last week, focusing on “hard” capacity (e.g, ICU beds and ventilators) overlooks “soft” factors that are harder to measure, but may impose an equally important constraint (e.g., staffing, medications, and essential supplies). Furthermore, the reported capacity may overstate actual capacity. For example, hospitals with multiple ICU facilities have been “cohorting” patients with Covid-19 disease to minimize cross-infecting critically ill patients. Therefore, the hospital may report having some ICU bed availability, but this availability may apply to some patients but not others (e.g., a new Covid-19 patient cannot be admitted to a non-Covid ICU bed). Additionally, some critical care beds may be in units that are not staffed to provide care for general medical conditions (e.g., Covid-19) but rather to patients with special needs (e.g., trauma or neurosurgery). These factors may lead to the use of “surge” beds before reported capacity is exhausted.

Simplistic projections of non-surge general ward and ICU capacity suggest Arizona could reach ward capacity by mid-July assuming no mitigation efforts are instituted and past trends continue unabated (Figure 5). Trends in ICU capacity seem more in line with trends in ward occupancy this week; therefore, some of the earlier ward trends may be spilling over into the ICU. Because mitigation efforts take 2 – 3 weeks, preventing a mid-July overflow requires action be taken within the next several weeks.

The possibility that Arizona might exceed its ICU capacity is supported by [CovidActNow](#) which shows markedly rising ICU utilization through early July. A similar, but less dire projection is made by the [Institute of Health Metrics and Evaluation](#). Similarly, the latest [ASU Covid-19 Modeling Group](#) simulations suggest adequate short-term capacity, but similar trends.

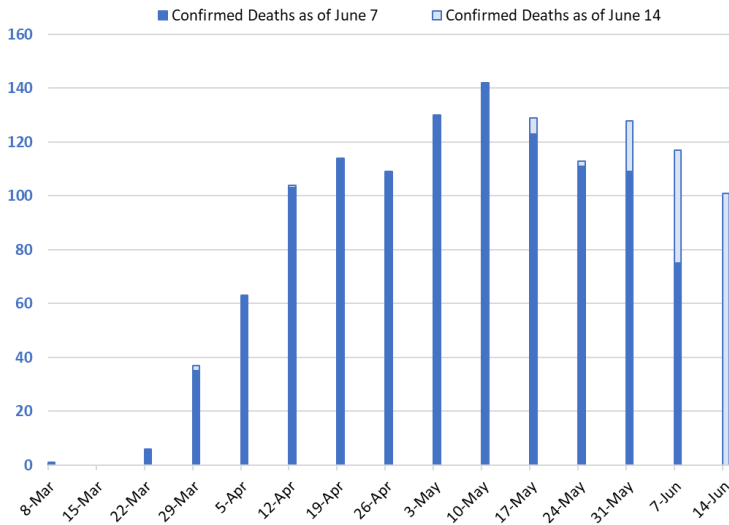


Figure 6. Weekly Arizona Covid-19 Deaths March 1 – June 14 by Date of Death

The week ending May 10th continues to be the week with the largest number of reported deaths at 142 deaths (Figure 6). To date, the doubling time for cumulative deaths, as measured by the date of death, continues to lengthen as illustrated previously in Figure 3 (page 2). When reporting lag and the expected 14-day interval between diagnosis and death is accounted for, the recent increases in case counts would not be expected to impact mortality trends until next week.

The Centers for Disease Control and Prevention (CDC) [aggregates various models](#) to provide a consensus view of the trajectory of new Covid-19 deaths nationally and in Arizona (Figure 7). These models predict cumulative deaths will continue to increase at roughly the same trajectory for the next 3 weeks.

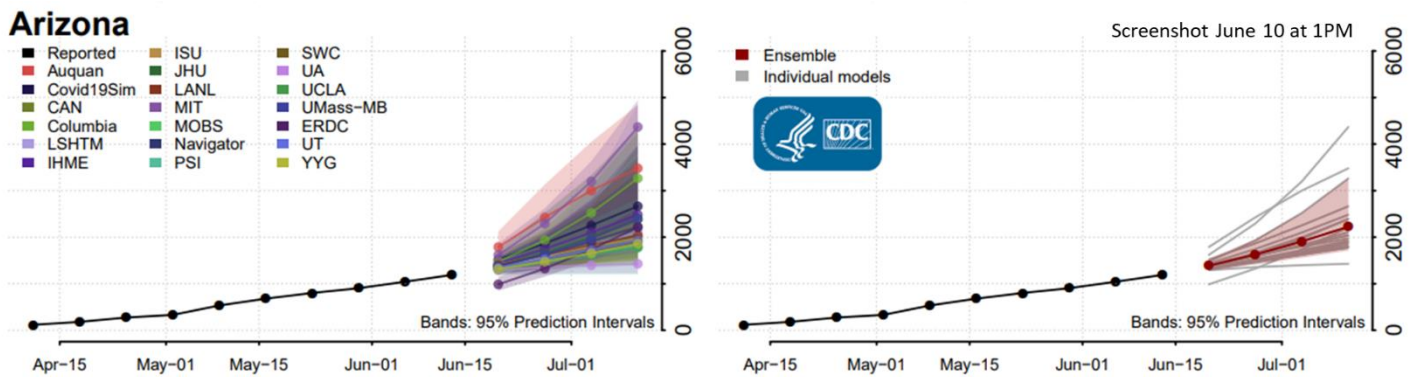


Figure 7. Centers for Disease Control and Prevention (CDC) Ensemble Forecast of Covid-19 Deaths in Arizona through July 15

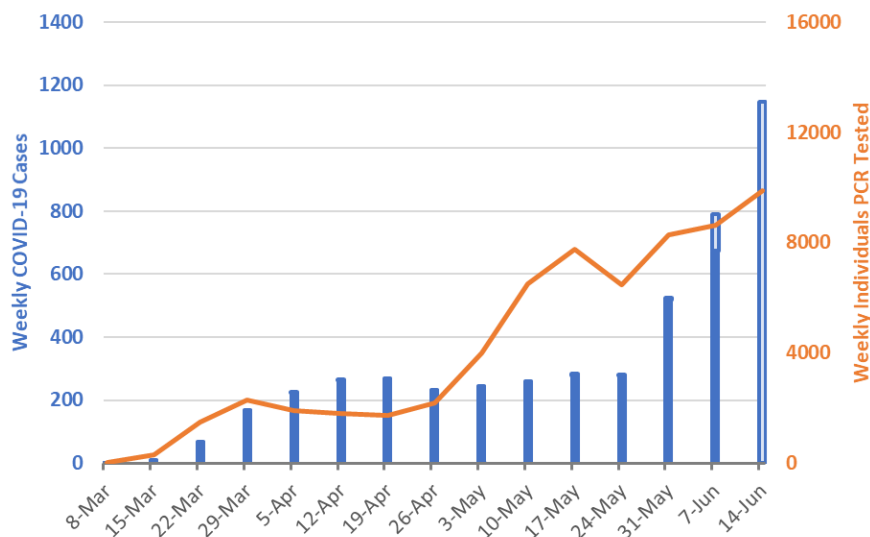


Figure 8. Newly Diagnosed COVID-19 Cases in Pima County and Individuals Tested through June 14

Pima County Outlook

For the week ending Sunday, June 14, weekly case counts again increased in Pima County, from 791 the prior week to 1147 cases this week, a 45% increase (Figure 8). Because testing capacity has recently begun increasing again, at least some of the increase could be attributable to more testing.

Figure 9 incorporates daily cases, weekly PCR tests, general ward occupancy and deaths into a single graphic. While it doesn't necessarily improve clarity, it does illustrate the temporal relationships, or lack thereof, between the most important pieces of information.

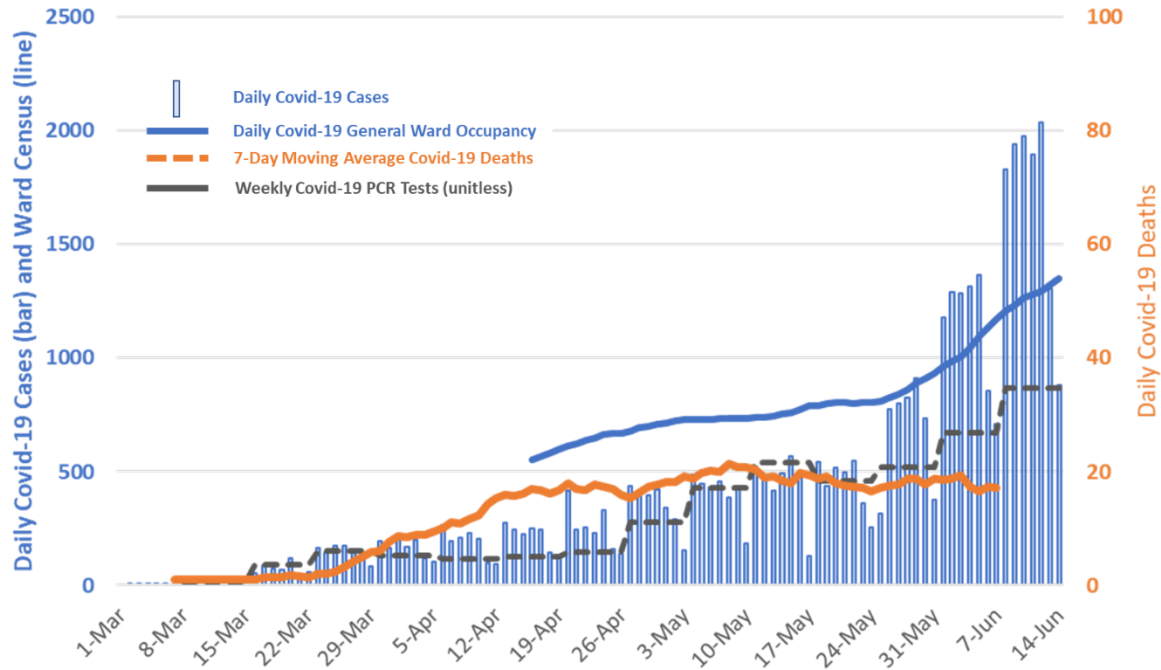


Figure 9. Arizona Covid-19 Cases, PCR Tests, Ward Occupancy, and Deaths through June 14

The relationship between new cases and markers of severe illness (hospitalizations and deaths) seemed to change in mid-April and then again in late May suggesting that different populations were at greater risk of becoming infected earlier in the course of the outbreak versus now? To explore this hypothesis, I examined two data elements in greater depth. First, the mean age at PCR testing, at diagnosis, and at death were examined (Figure 10).

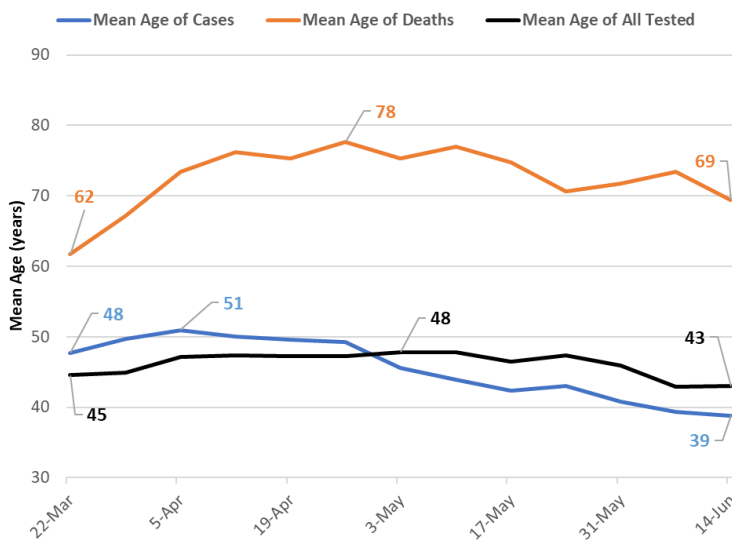


Figure 10. Mean Age at COVID-19 PCR Testing, Covid-19 Diagnosis, and Death March 22 – June 14

The mean age at PCR testing was 45 years the week of March 22, reached a peak at 48 years the week of May 3, and declined to 43 years currently. The mean age at Covid-19 diagnosis was 48 years the week of March 22, reached a peak at 51 years the week of April 5, and has since declined to 39 years this past week. The [meaningful decline in age at diagnosis](#) could have important implications for hospitalization demand and mortality since younger individuals are at less risk of developing severe illness.

The mean age at death was 62 years the week of March 22, reached a peak at 78 years the week of April 27, and has since declined to 69 years. It is a bit more difficult to understand what trends to expect for mortality, but it is possible that early outbreaks in long-term care and skilled nursing facilities could have contributed to the peak age at death in late April.

The second line of inquiry involved diverging trends in general ward and ICU occupancy for Covid-19 (Figure 11). General ward occupancy has been increasing faster than ICU occupancy. When data were first available, the ratio of ward occupancy to ICU occupancy was 2:1, now it is 3:1. If the age at diagnosis is declining because different populations are at risk versus different populations are being tested, then fewer high acuity ICU admissions, and deaths, would be expected. This could be explained by working age adults returning to the economy while older, higher risk adults remain sheltered owing to their own volition. If true, a higher level of infections could be maintained with a fixed hospital capacity.

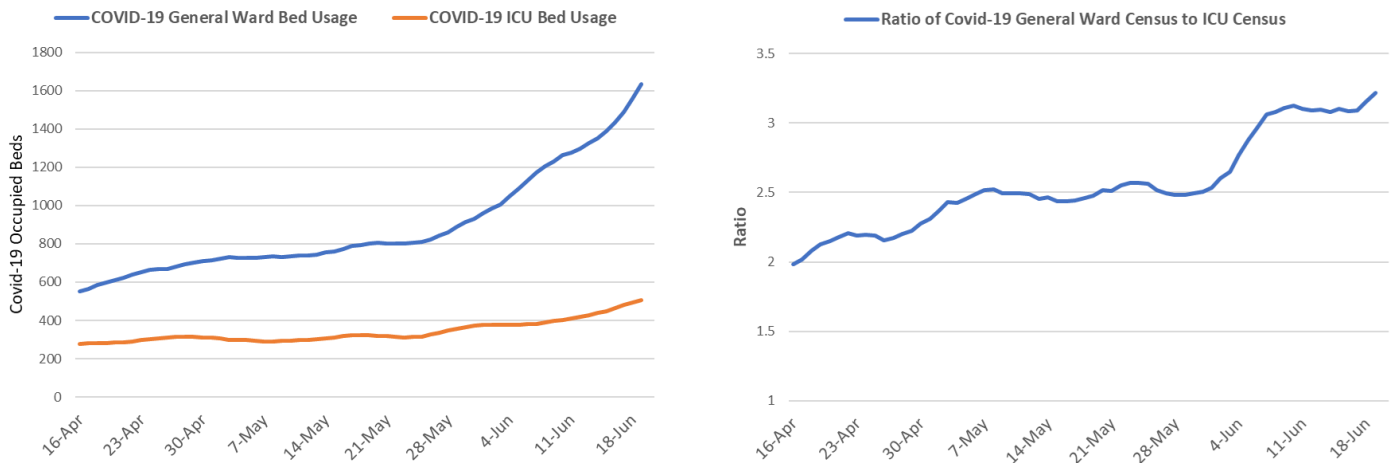


Figure 11. Arizona Covid-19 General Ward and ICU Occupancy (left) and Ratio (right) through June 19

Summary:

- Reported cases and hospitalizations, but not deaths, continue to increase at a rapid pace signaling increasing community spread. While these trends differ by geographic region, Covid-19 is widespread in Arizona (see Appendix for county data).
 - Absolute levels of community-driven viral transmission have never been higher as evidenced by frequent daily and weekly record-setting levels of newly reported cases.
 - For most locales, additional government-mandated social distancing restrictions and/or mask-wearing are urgently needed to reduce the pace of community transmission.
 - The nature of the outbreak is changing such that new infections are shifting towards younger, working-age adults which has important implications for hospital utilization and deaths.
- Covid-related hospital utilization continues to increase while excess capacity is declining. Adequate capacity currently exists, but excess capacity could be depleted by early-to-mid July.
 - Some hospitals are already near or at capacity for ICU care; therefore, local conditions will provide a better indicator of capacity than state-wide trends.
 - Stated capacity may over-estimate actual capacity for structural reasons; therefore, surge beds may be needed sooner than expected.
- The number of Covid-19 tests is not keeping pace with rising case counts as evidenced by increasing PCR test positive rates. Positivity rates remain >3% indicating capacity is likely inadequate to meet clinical and public health demands. Test reporting lags appear to be about the same.

Next update scheduled for Jun 26; county data on following page.

Arizona Counties Outlook

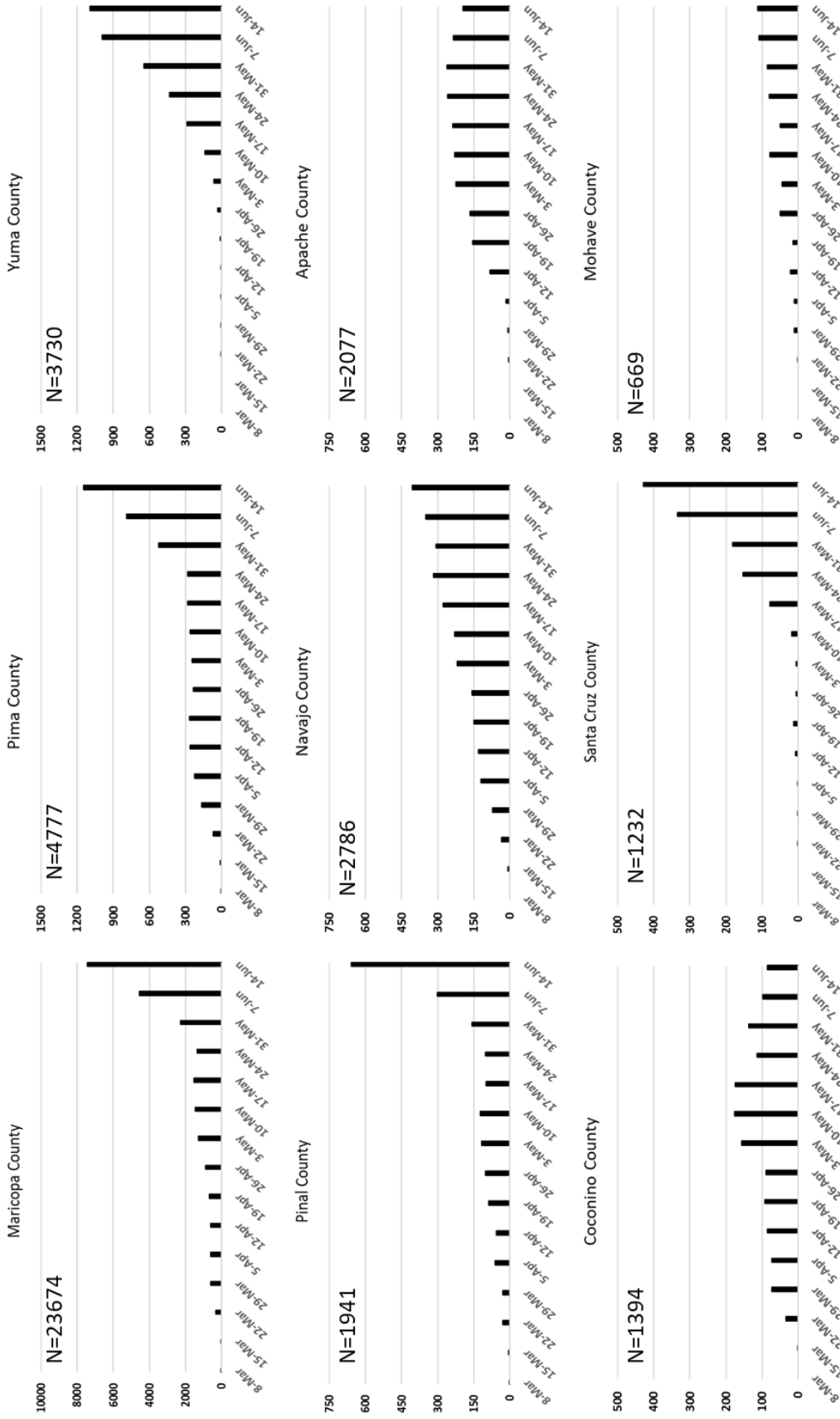


Figure 10. Weekly Covid-19 Case Counts across Arizona Counties with more than 360 Cases

Created by: Joe K. Gerald, MD, PhD (Associate Professor, Zuckerman College of Public Health, geraldj@email.arizona.edu) with gratitude to Patrick Wightman, PhD, MPP from the UA Center for Population Health Sciences for assistance with data analysis.