Covid-19 Disease Outbreak Outlook
Arizona State and Pima County
Updated July 17, 2020

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For the week ending July 12th, 15160 new Covid-19 cases were reported in Arizona (Figure 1). However, this tally undercounts the actual number of new cases as 50% of PCR results are taking ≥5 days to be reported. For this reason, last week's tally has been revised from 20123 to 26540 cases, a 32% increase. Even with this large backfill, 4% fewer cases were reported the week ending July 5 versus the week ending June 28.

However, this decline should be viewed skeptically because the number of PCR tests conducted was lower than expected. Instead of increasing by 15 – 35%, the number of tests performed the week ending July 5 fell by 2%. If testing had increased by the historical average of 25%, and if 20% of results would have been positive, then 28500 additional tests and 5700 additional cases would have resulted. This would have yielded a 16% increase in new cases from June 28 to July 5 instead of a 4% decline. All to say, some uncertainty remains regarding how much progress was made this week.

While testing results are still incomplete, the percent of patients testing positive declined from 23.2% the week ending July 5 to 19.2% the week ending July 12 (Figure 2 following page). A declining test positive percentage in the face of declining testing capacity lends additional evidence that viral transmission is slowing in response to the public's adherence with new face mask ordinances, additional business restrictions, and other recommended health behaviors. The seroprevalence increased from 5.6% to 7.0% the week ending July 12 indicating a small, but growing pool of recovered individuals.

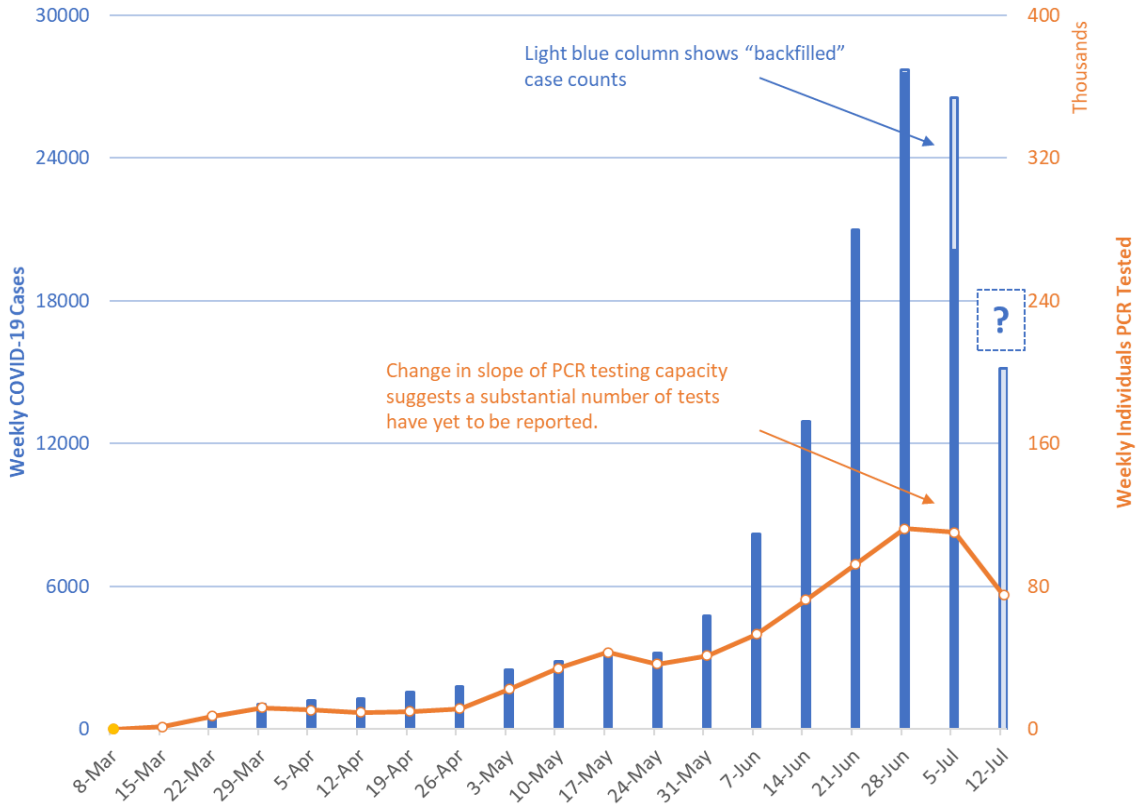

Figure 1. Newly Diagnosed Covid-19 Cases in Arizona and Number of Individuals Undergoing PCR Testing March 1 through July 12.

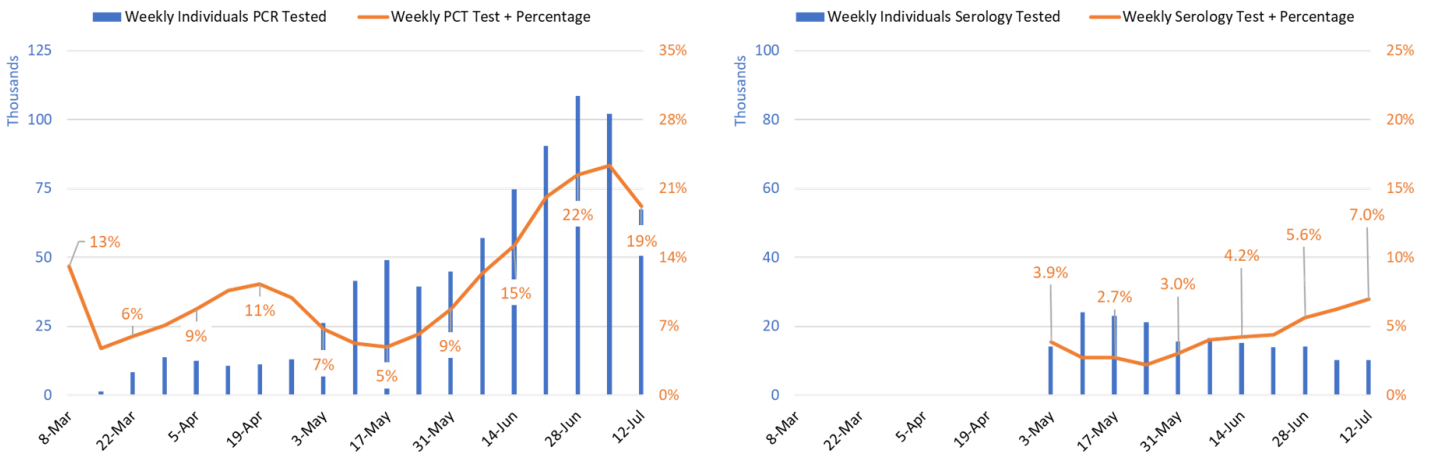

Figure 2. Weekly Number Patients Tested and Percent of Individuals with Positive Covid-19 PCR and Serology Results March 1 - July 12

The 7-day moving average of doubling time for cumulative Covid-19 cases shortened from a peak of 29 days on May 25th to a trough of 12 days on June 21st (Figure 3). As of July 5th, it was 19 days. Because testing lag artificially lengthens doubling time, I am not displaying new case data through July 12th as I normally would. Despite backfilled data, the doubling time for cases is lengthening indicating generally improving conditions. A similar graphic with key policy interventions is presented in Figure 4 on the following page.

The doubling time for cumulative deaths has shortened from a high-water mark of 42 days on June 5th to a potential trough of 29 days on July 1st. As of July 5th, it was 31 days. As deaths lag case identification by approximately 2 weeks, the pace of newly deaths should slow in the next week or two. If so, it provides confirmatory evidence that the improving trends in case counts are real.

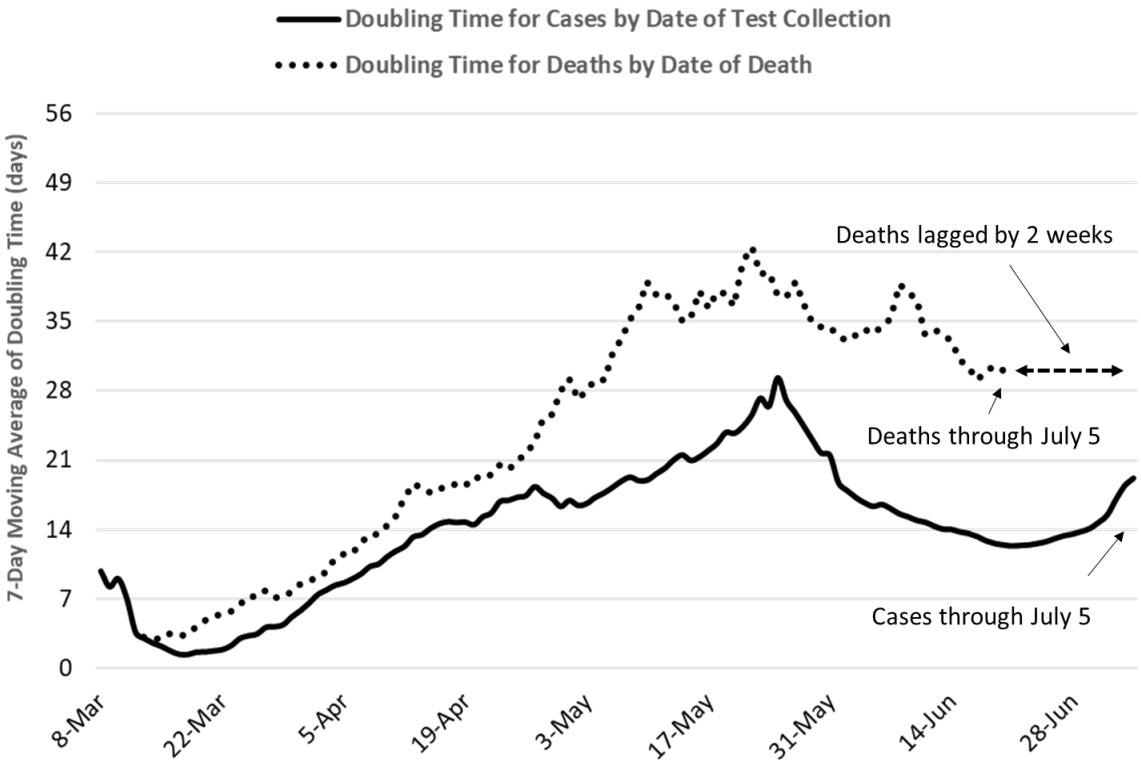

Figure 3. 7-Day Moving Average of Doubling Time of Cumulative Cases through July 5 Superimposed on Lagged (2-week) Doubling Time of Cumulative Deaths through July 5.

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.

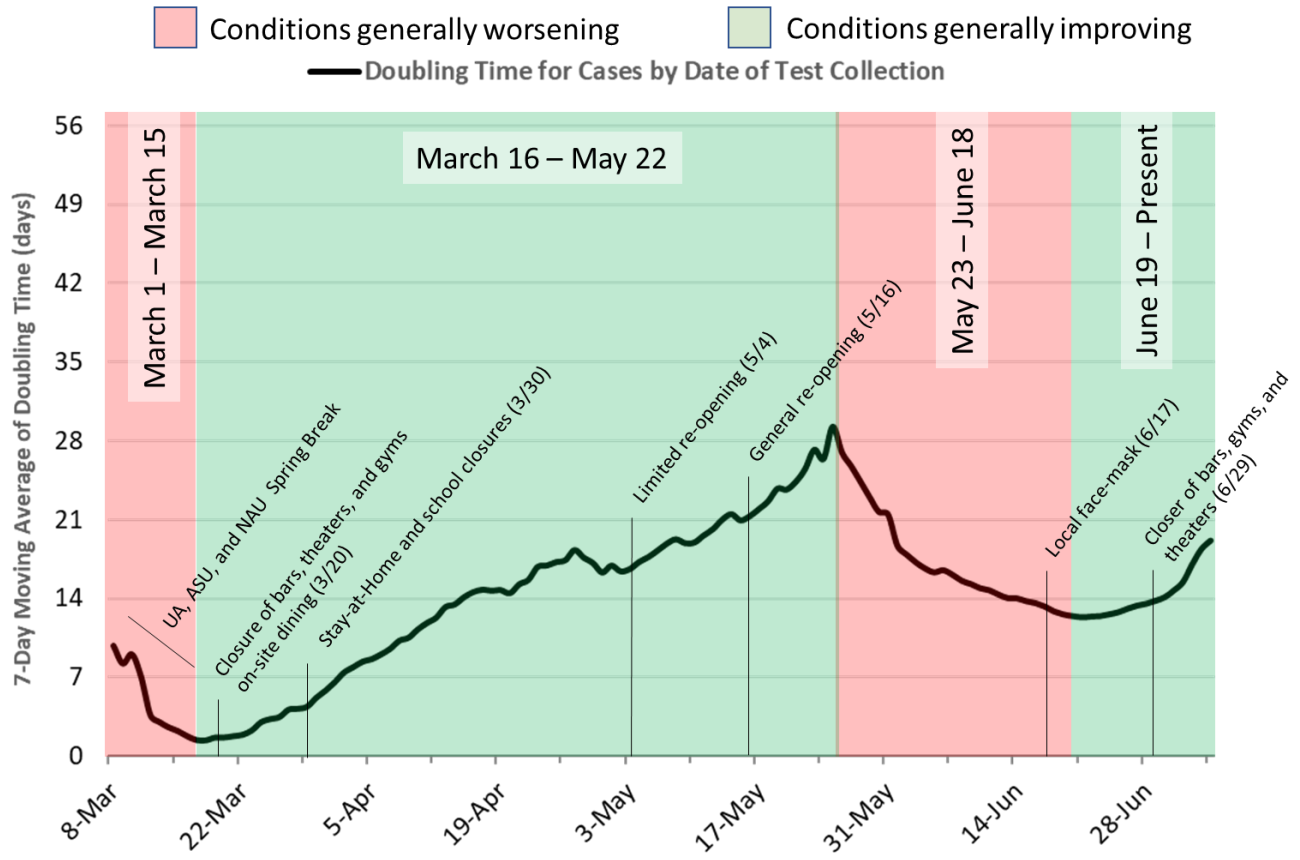

Figure 4. 7-Day Moving Average of Doubling Time of Cumulative Cases through July 5 with Key Policy Covid-19 Policy Actions.

From a May 22 plateau to a potential July 13 plateau, total Covid-19 hospitalization increased 311% from 1093 to 4487 occupied beds (Figure 5). Since last week, total Covid-19 hospitalizations increased 1% from 4384 to 4410 occupied beds. If recent case counts trends continue, then hospitals should see stabilizing or declining admissions over the coming weeks.

As of July 17, 3238 (41%) of Arizona's 7869 general ward beds were occupied by patients with suspected or confirmed Covid-19 infection, a 7% decline from last week. An additional 1100 (14%) beds remain available which is higher than last week's 946 beds. Similarly, 894 (53%) of Arizona's 1695 ICU beds were occupied for Covid-19 care; essentially unchanged from last week. Similar to last week, 189 (11%) beds remain available.

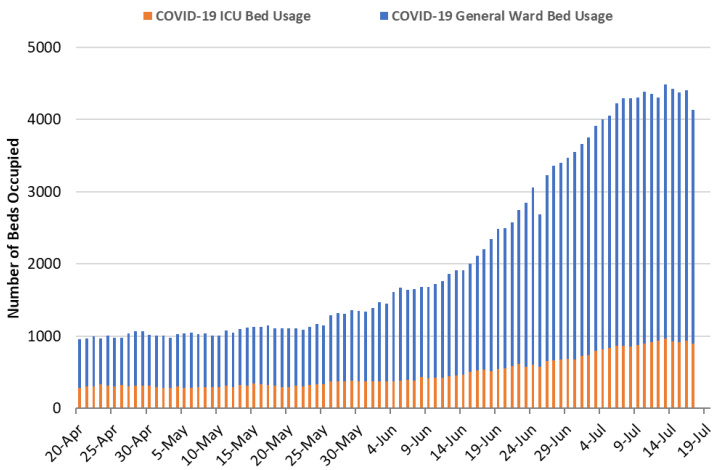

Figure 5. Arizona Daily Covid-19 General Ward and ICU Census April 20 – July 17.

Now that Covid-19 hospital admissions are stable or declining, it appears that Arizona will not exceed its listed capacity of non-surge general ward or ICU beds in the near future unless recent improvements reverse (Figure 6). Due to the longer length of stay for critically ill ICU patients, strain on general ward beds should be relieved sooner than on ICU beds. In large measure, Arizona was able to withstand the most recent surge in cases because cases were younger, and admissions coincided with the seasonal reduction in hospital occupancy. Moving forward, the demographics are unlikely to change further and seasonal trends will reverse.

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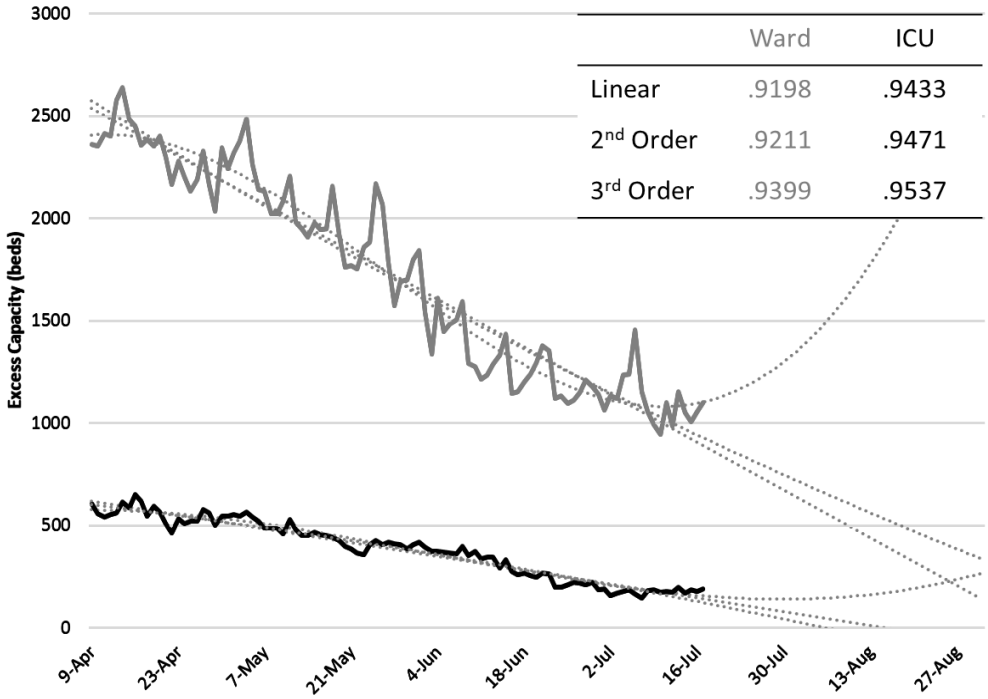

Figure 6. Observed and Projected Excess Non-Surge General Ward and ICU Capacity April 20 – August

With 339 deaths reported to date, the week ending July 5th is now the week with the largest number of Covid-19 deaths eclipsing the 260 deaths the week ending June 28th (Figure 7). However, 273 deaths have already been reported for the week ending July 12th suggesting it will set a new record once all deaths are reported. Because deaths lag new cases by about 2 weeks, deaths should continue to increase for the next week or two before moderating or declining.

Now that the butcher's bill is readily apparent, it is clear that Arizonans paid a heavy toll in avoidable deaths and hospitalizations following the lifting of the state's 'Stay Healthy, Return Smarter, Return Stronger' executive order.

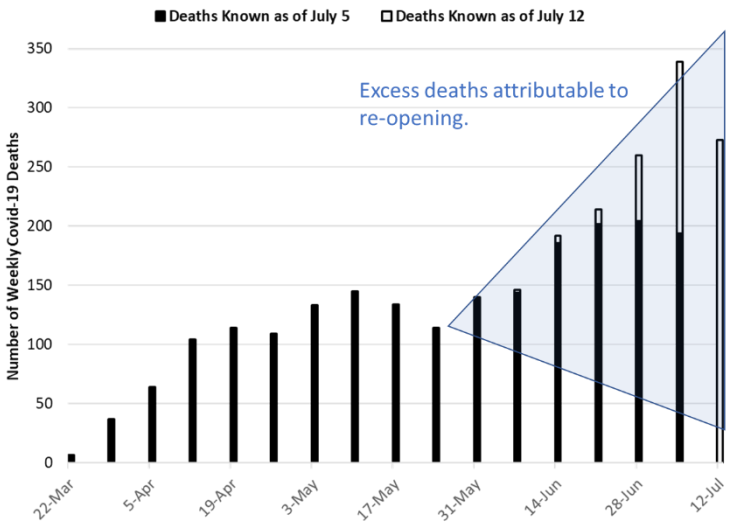

Figure 7. Weekly Arizona Covid-19 Deaths March 1 – July 12 by Date of Death

In contrast to generally declining deaths during May, June saw a substantial increase as physical distancing restrictions were lifted. This was the predicted result of greater frequency and intensity of human interactions. While each Arizonan will have to examine their own circumstances, for me, the economic benefits were not worth the price paid in blood. The decision to re-open was an ill-advised choice, that was an unforced error. Similarly, the Governor's decision to delegate decisions regarding face coverings to local leaders was equally ill-advised. Fortunately, many of our elected county and municipal leaders have provided effective leadership in the vacuum left by the Governor and his key public health advisors. For all who advocated for stronger physical distancing measures and face coverings, I thank you for your efforts as the evidence indicates these measures have mitigated viral transmission, protected many at-risk Arizonans and helped preserve our healthcare system's ability to provide care to those who were in need.

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Pima County Outlook

For the week ending July 12, 1228 Pima County residents were diagnosed with Covid-19. Like state-wide figures, this count underestimates the number of diagnosed cases owing to the reemergence of a sizable testing lag. For example, last week's count of 1732 cases was revised to 2261 cases this week, a 31% increase (Figure 8).

Nevertheless, the week-to-week increase from June 28 to July 5 was 1 case (2260 to 2261) which is smaller than the previous weeks' increases providing evidence that the pace of new case counts is slowing. Given that Pima County and Tucson instituted face mask ordinances quickly after being permitted to on June 17th, it supports their important role in our public health response.

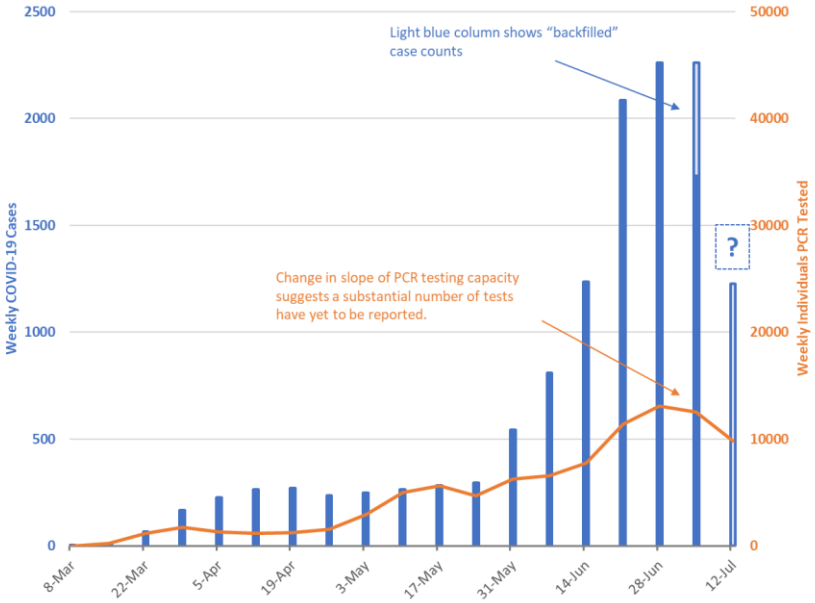

Figure 8. Newly Diagnosed Covid-19 Cases in Pima County and Individuals PCR Tested through July 12.

Summary:

- Compelling evidence indicates the pace of viral transmission has appreciably slowed over the past weeks indicating that recent mitigation efforts are working. If true, deaths should moderate within the next several weeks. Nevertheless, Covid-19 remains widespread in Arizona.
    - Reporting lag for PCR results is still complicating efforts to precisely gauge changes in viral transmission and conduct timely case identification, contact tracing, and isolation.
    - Absolute levels of community-driven viral transmission have never been higher as evidenced by record numbers of weekly Covid-19 cases.
    - For most locales, government-mandated social distancing restrictions and mask-wearing will be needed for the foreseeable future. Additional restrictions may be necessary to relieve overcrowded hospitals and secure additional capacity for seasonal respiratory infections.
- Covid-related hospital utilization is moderating while excess capacity is being better preserved. Adequate capacity should be available for the foreseeable future. Personnel shortages and fatigue will still be problematic, especially in critical care settings.
    - From now until January, non-Covid hospitalizations are expected to increase putting additional strain on hospital capacity.
    - Many ICUs will remain at or over capacity for the next several weeks due to long length-of-stays for many; maintaining an adequate supply of health care workers will continue to be a challenge.
- Current Covid-19 test capacity is inadequate to meet both clinical and public health demands as the test positive percentage is 19%, well above the recommended 3 – 5%. With half of results taking 5 or more days, our public health efforts to respond to this outbreak remain constrained by inadequate capacity.

Next update scheduled for July 24. County data follows in the Appendix.

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Should Schools and University Resume In-Person Education this Fall?

Should schools and universities resume in-person activities this fall? If so, under what circumstances? From a public health perspective, it is not currently safe to bring students back for in-person education. Viral transmission cannot be contained when many individuals gather in enclosed spaces for prolonged periods of time. This is especially true when absolute levels of community transmission are high, when inadequate testing capacity exists, when public health laws are inadequate and unenforced, and when insufficient resources are available to conduct case identification, contact tracing, and isolation. Conditions for a safe return have not materially improved since I wrote this on March 28 when the University of Arizona closed its doors:

- With a high reproductive number ($R_0 = 2.5$), SARS-CoV-2 is a highly capable adversary that will severely punish any delays or mistakes in our public health response.
- With up to 20% of SARS-CoV-2 infections being asymptomatic (*we now know it is much higher*), the virus has stealth capabilities that will make the infections we don't see more dangerous than one's we do.
- With our public health response hampered by severe testing limitations, our medical response hampered by too few effective treatments, hospital beds, and ventilators, and our ponderous vaccine development timeline, we are way behind the technology curve.
- Traditional public health responses like contact tracing plus quarantine and temporary social distancing are unlikely to be sufficient to control this particularly resistant outbreak of the novel SARS-CoV-2 virus.

I know other experts have shared thoughtful pieces arguing that we should re-open schools IF schools have a good infection control plan to safeguard students and staff AND schools have a robust testing procedure in place to monitor potential outbreaks (see here, here, here, and here). In Arizona, re-opening is not prudent for two primary reasons. Foremost, the absolute number of cases is too high despite recent improvements. When schools were originally closed the last week of March, there were 1000 reported cases that week; this past week there were 26000! We have no safety margin (e.g., hospital capacity) should the decision to re-open reignite community transmission. Second, testing capacity is inadequate in both quantity and responsiveness. Our test positive percentage is 19%! Approximately one-half of results are reported 5 or more days after the test is performed! Public health surveillance efforts cannot be effective under current conditions.

Arizonans have already paid a high price for the overly optimistic, self-interested, ideologically driven policy decisions: delaying our initial stay-at-home mandate, lifting it early, and inconsistently requiring face coverings. These decisions have driven Arizona to the third highest state in cases per capita; only New York and New Jersey have experienced worse. While we are "only" 15th in Covid-19 deaths, our deaths are still mounting. In trade-off, we have the 19th worst June unemployment rate. It should now be clear that our choice isn't between saving the economy OR saving our lives but rather saving our lives will save our economy.

It is time for a dramatically different policy approach in Arizona. Unless we safeguard the public's health, our economy will continue to suffer along with its people. We should have faith that medical science will continue to identify and develop new treatments and produce an effective vaccine. Until such a time, we should "hunker down" and get "our house in order." We need to redouble our efforts at physical distancing, particularly in high-risk settings (e.g., enclosed, prolonged contact in confined spaces), and at wearing face coverings in public spaces. Over many weeks, these efforts will lead to a sustained decline in cases and deaths until absolute cases counts will be low enough to warrant broader re-openings. Fewer cases will ease the burden on our health care system and make more tests available for public health surveillance.

Keeping our schools closed will undoubtedly disrupt many lives, disadvantage students, threaten teachers' livelihoods, and place great strain on families. These consequences cannot be prevented but they can be mitigated with federal, state, and local support. Acceptable, short-term alternatives can be found until such a time that we can resume our lives. This decision will be hard, but in my experience, doing the right thing almost always is.

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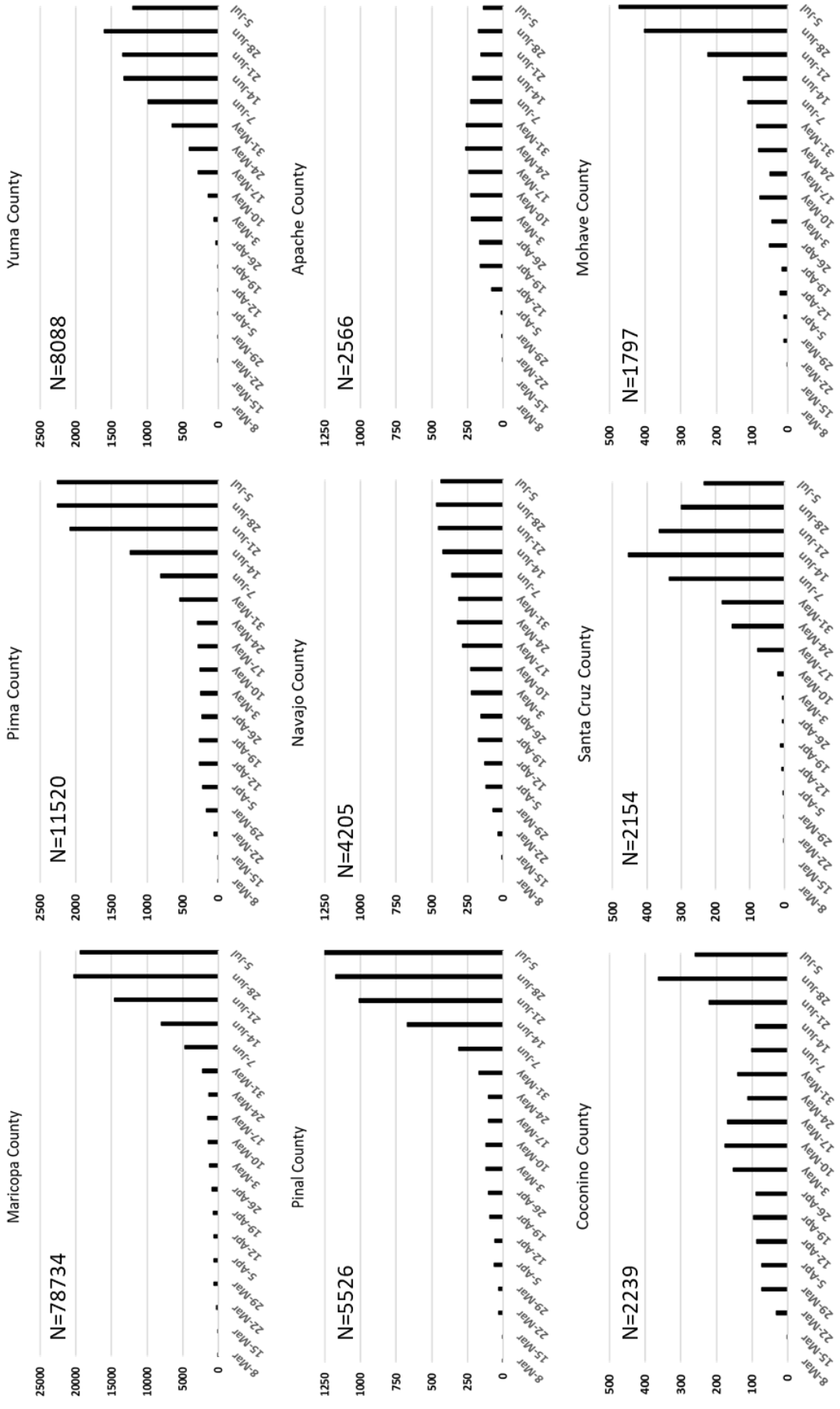

Appendix Figure 1. Weekly Covid-19 Cases by County March 1 – July 5 (Note: Typically, data would be displayed through the week ending July 12; however, the reemergence of a sizable reporting lag makes data from the most recent week unreliable).

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