

Covid-19 Disease Outbreak Outlook

Arizona State and Pima County

Updated June 5, 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, May 31st, 4400 new Covid-19 cases were reported in Arizona (Figure 1). This tally is the largest yet reported by a substantial margin. Because of continued reporting lag, this tally may undercount the actual number cases detected this past week. For example, last week's update reported 2428 new cases for the week ending May 24th. However, that count has been revised upwards by 28% to 3110 cases this week. The number of tests collected was revised by a similar amount (not shown).

While rapid expansion of testing previously made it difficult to draw meaningful conclusions about the underlying dynamics of viral transmission, that is no longer the case. For the past 2 weeks, testing has been relatively flat suggesting that increasing case count indicate increase viral transmission. Although an incomplete counting, at least 43406 individuals provided 53124 PCR samples this past week of which 8.7% were positive; 16190 individuals provided 23673 serology samples of which 3.3% were positive.

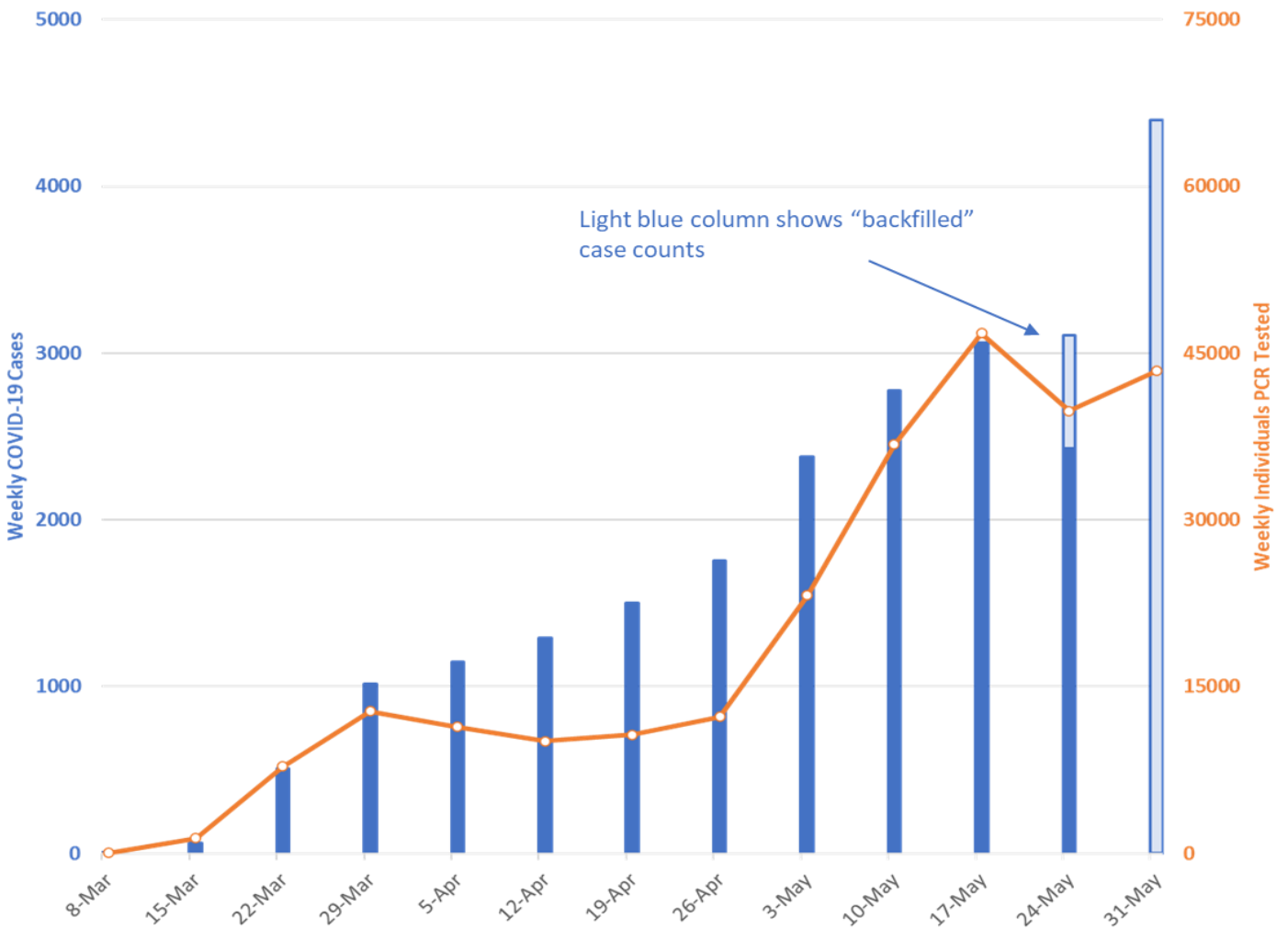


Figure 1. Newly Diagnosed Covid-19 Cases in Arizona and Number of Individuals Tested through May 31

Tracking doubling time is a simplistic approach to estimate the pace of viral transmission. All things being equal, lengthening doubling times indicate slowing transmission while shortening times indicate faster transmission. Using the 7-day moving average of changes in cumulative Covid-19 case counts, May 25th signaled a transition from generally lengthening to generally shortening doubling times. On May 25th, the doubling time was 34 days, but it has since declined to 17 days. After taking incubation period (5 - 6 days), delay until testing (5 – 7 days), and the mid-point of the 7-day moving average (3 – 4 days) into account, the true pace of viral transmission likely increased around the first week of May when Arizona’s physical distancing order were relaxed.

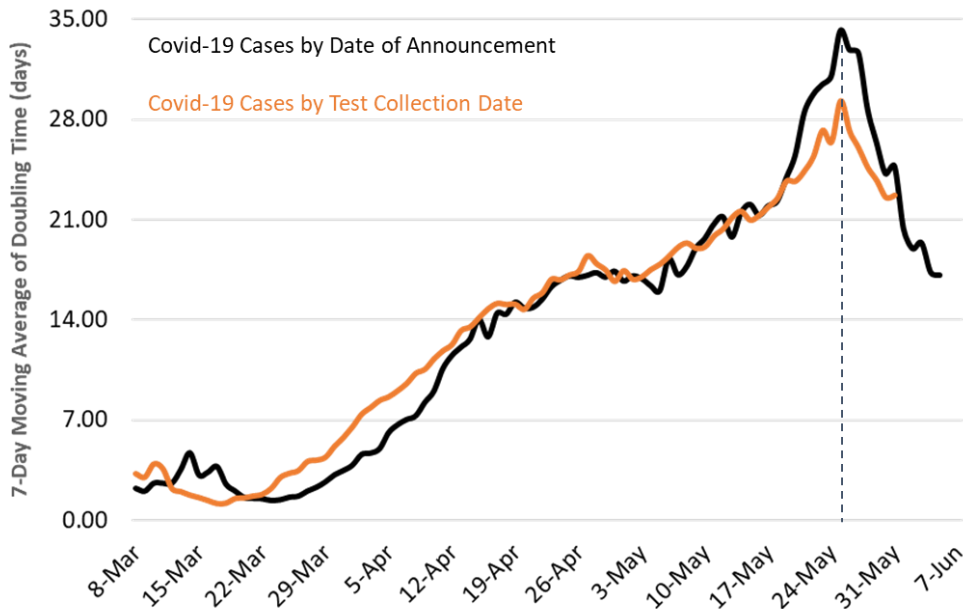


Figure 2. 7-Day Moving Average of Doubling Time of Cumulative Covid-19 Cases in Arizona through June 5.

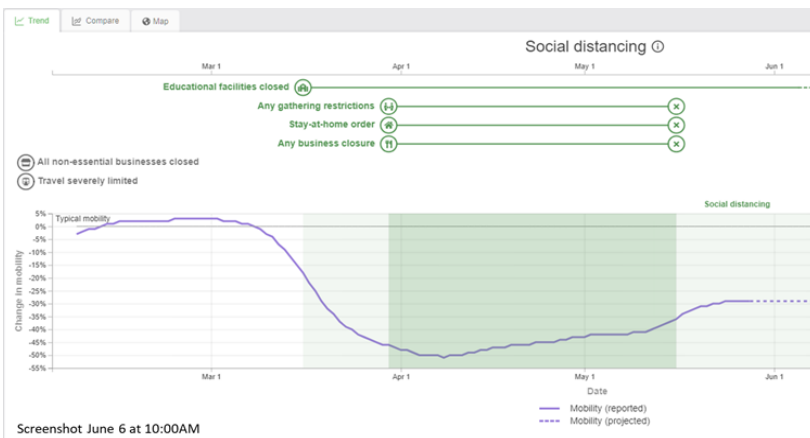


Figure 3. Social Distancing Metrics Provided by Institute of Health Metrics and Evaluation (IHME)

Linking changes in doubling time with changes in government policies and/or human behavior is inexact without sophisticated methods. However, Arizonans’ seemed to develop quarantine fatigue in mid-April as measured by the [Institute of Health Metrics and Evaluation](#) (IHME, Figure 3). These data are corroborated by the [Social Distancing Scoreboard](#) provided by Unacast. These changes predate the relaxation of Governor Ducey’s stay-at-home order on May 4th and its rescission on May 15th. It plausible that these changes tipped the scale in favor of increasing viral transmission in late April or early May which is consistent with increasing case counts this past week.

Rapid testing changes can obscure the true nature of these underlying trends by identifying individuals with milder disease who might not otherwise have been tested. Doing so may alter the prognostic utility of case count trends because these individuals will never be hospitalized or die. However, identifying and adjusting for it is difficult.

The average time between case detection and death may provide some clues. The time between a positive Covid-19 test and death has been increasing since the start of the outbreak (Figure 4). This interval increased from 7 days in early April to 14 days in mid-May. Heightened clinical suspicion and/or expanded testing capacity would be expected to identify cases earlier in the disease course and thereby increase the interval between a positive test and death. Unfortunately, it does not answer whether individuals with milder disease are being preferentially identified by increased testing.

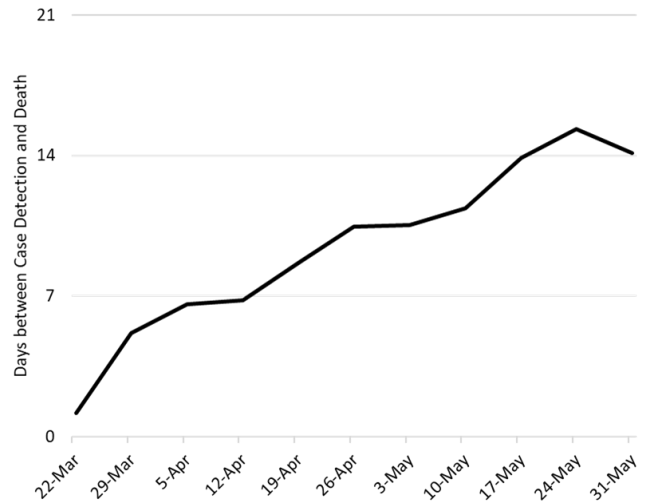


Figure 4. Time between Case Detection and Covid-19 Deaths March 22 – May 31.

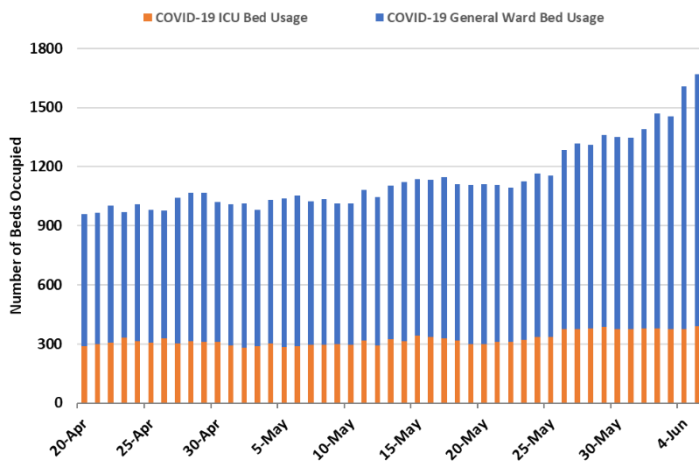


Figure 5. Arizona Daily Covid-19 General Ward and ICU Census April 20 – June 5

The number of ward and ICU beds devoted to Covid-19 care increased 24% from last week to 1669 beds this week marking the second week of such an increase. Fortunately, excess capacity only declined by 12% this week and 2% last week.

Increasing hospital utilization strongly suggests that increasing case counts are attributable to increases in community transmission. If current trends are sustained, excess capacity could be exhausted by July. [Banner Health recently reported](#) some of its Maricopa ICUs were already at or near capacity. Locally, Banner University Medical Center Tucson is also experiencing increases. Because interventions take weeks to take effect, immediate action is needed to avoid exceeding our hospitals' capacity to provide care.

Because some will become severely ill, hospitalization and ICU trends can corroborate case count trends (Figure 5). As of June 5, 1278 (13.1%) of Arizona's 9769 general ward beds were occupied by patients with suspected or confirmed Covid-19 infection. This is a 31% increase from last week when 973 (9.6%) of 10187 beds were occupied. An additional 1449 (14.2%) beds remain available which is lower than the 1,682 (16.5%) available last week. Excess ward and ICU capacity has been declining since early April (Figure 6)

Similarly, 391 (17.7%) of Arizona's 2208 ICU beds were occupied this week, a 4% increase from last week when 376 (16.6%) of 2267 beds were occupied. An additional 373 (16.9%) beds remain available which is lower than the 380 (16.8%) available last week.

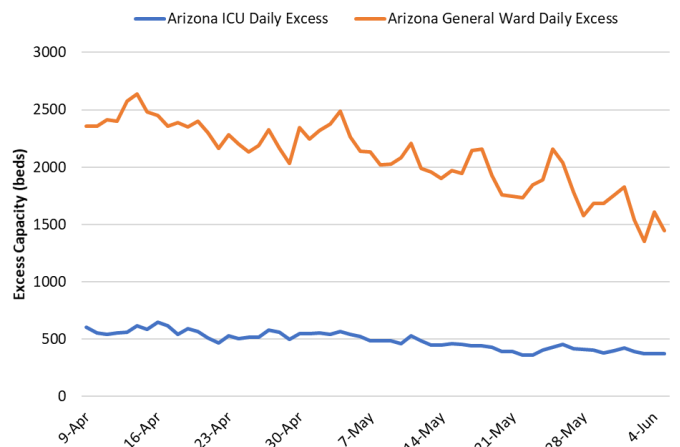


Fig 6. Excess Ward and ICU Capacity Apr 9 – Jun 5

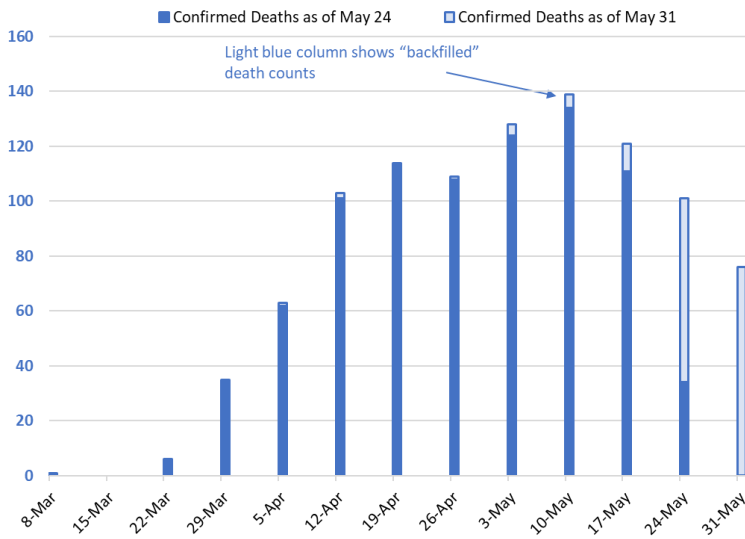


Figure 7. Weekly Arizona Covid-19 Deaths March 1 – May 31 by Date of Death

As of June 5th, 1012 deaths have been announced in Arizona; however, reporting lag makes it difficult to interpret these counts in real-time. The week with largest number of deaths by date of death continues to be the week ending May 10th with nearly 140 deaths (Figure 7).

The interval between case detection and death (Figure 4 above) is now approximately 14 days. When added to the 2-week reporting lag, recent case count increases will not be detectable in mortality trends, as documented by date of death, for several more weeks. Although less reliable, a signal may be observable when trends in death are examined by their date of announcement.

The doubling time for cumulative deaths, as measured by their date of announcement, shows a deflection on May 26 (Figure 8). The doubling time declined from 45 days on that date to 34 days on June 5. A prior deflection beginning May 1 is likely attributable to a new Covid-19 case definition that incorporates probable deaths. When trends are examined by the actual date of death, no similar deflection is observed. However, these data are only reliable through May 24 owing to reporting lag. Because doubling time measured by date of announcement and date of death have been less strongly correlated since early May, caution is urged when interpreting trends.

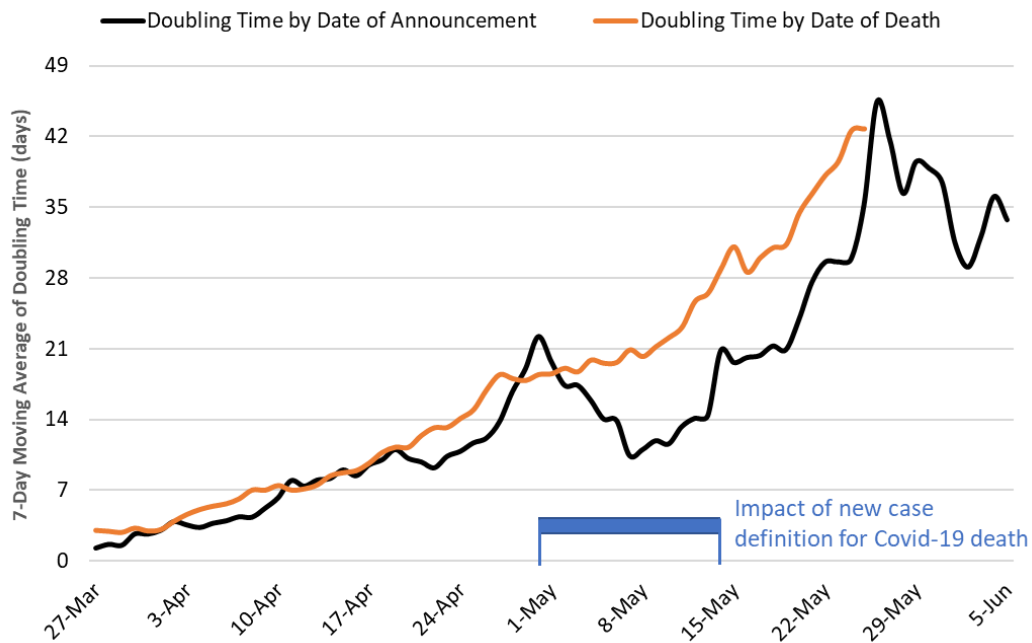


Figure 8. 7-Day Moving Average of Doubling Time of Cumulative Covid-19 Deaths in Arizona through June 5.

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 9). These models predict cumulative deaths will continue to increase at roughly the same trajectory for the next 3 weeks. So far, they are not detecting a signal of increased transmission.

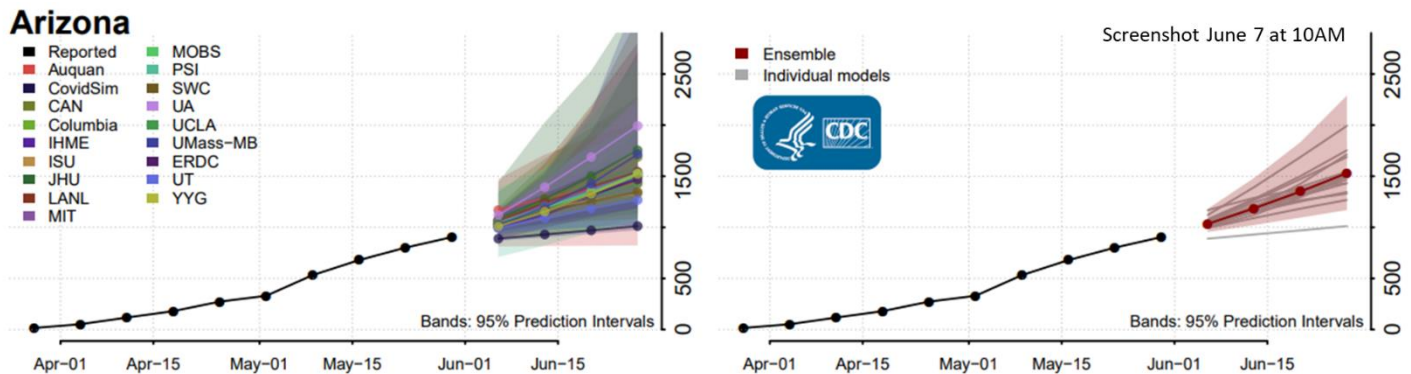


Figure 9. Centers for Disease Control and Prevention (CDC) Ensemble Forecast of Covid-19 Deaths in Arizona through June 22

It is worth revisiting the work of the Arizona State University Covid-19 modeling group ([see their preprint](#)). Using an SEIR epidemiological model, they examined various scenarios of physical distancing policies including a comparison of a May 15 (early) versus June 1 (late) re-opening (Figure 10). Dividing their daily estimate of new cases by 4X to derive PCR confirmed cases, they estimated that by the time of this update Arizona would see roughly 1500 confirmed cases per day versus about 7500 per day with early reopening which is roughly tracking current conditions. More worrisome is the future trajectory showing even faster growth without action.

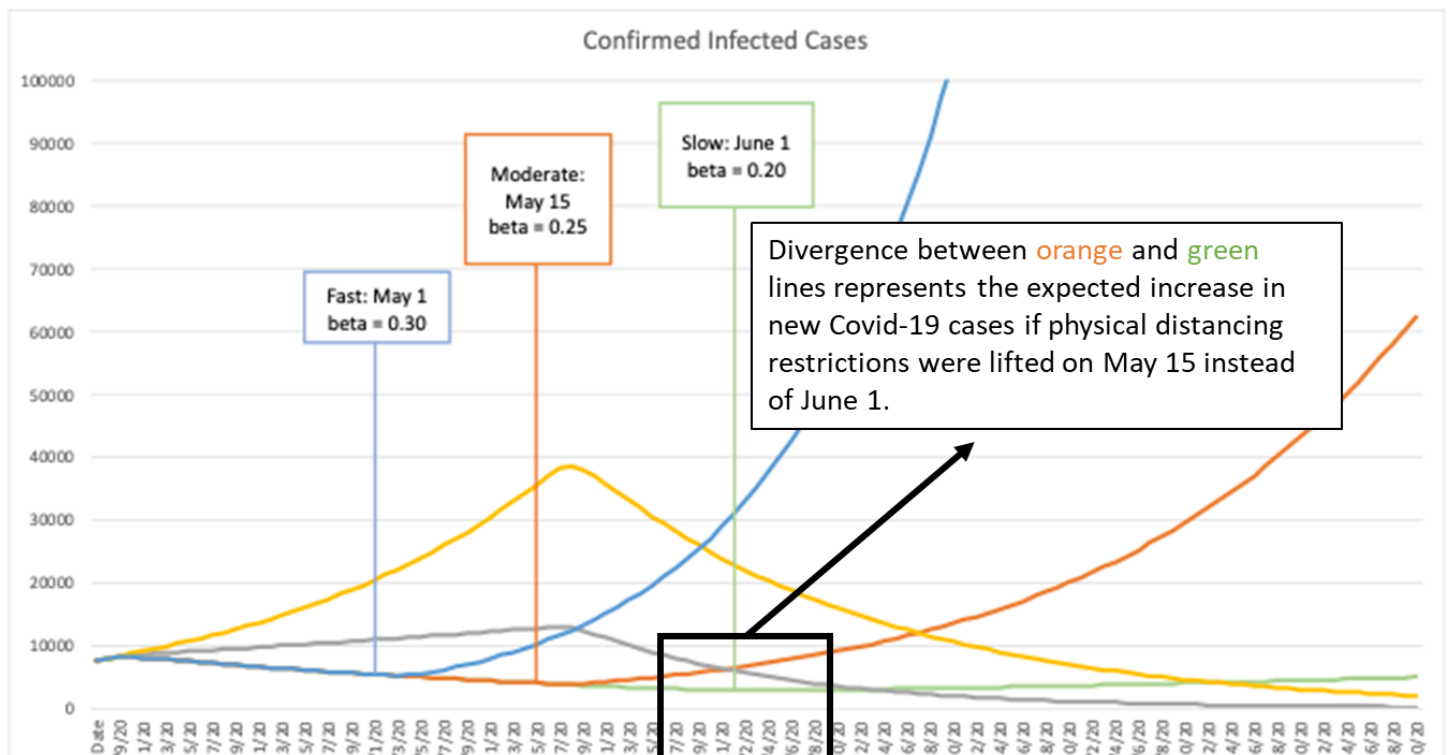


Figure 10. Simulated Scenarios of COVID-19 Infection in Response to Social Distancing Policy. ADHS COVID-19 Modeling Working Group 1, Arizona State University: Tim Lant, PhD, MAS (tim.lant@asu.edu); Megan Jehn, PhD; Esma Gel, PhD; Anna Muldoon, MPH; Heather Ross PhD, DNP, ANP-BC. April 20, 2020.

Pima County Outlook

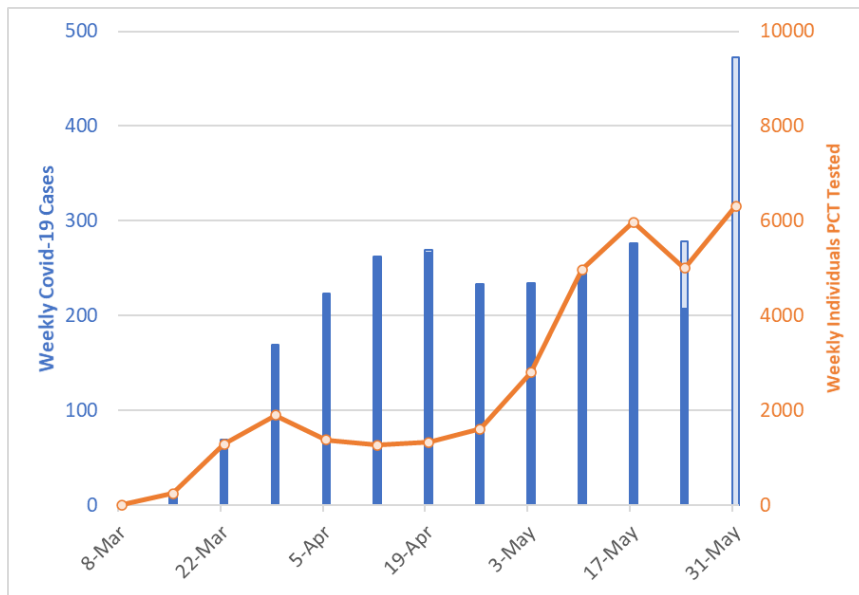


Figure 11. Newly Diagnosed COVID-19 Cases in Pima County and Individuals Tested through May 31

For the week ending Sunday, May 31, weekly case counts dramatically increased from 278 the prior week to 472 cases this week (Figure 11). Because testing capacity has not changed for the past 2 weeks, these data suggest that the pace of viral spread is increasing after a period of decline in mid-April.

Given the dramatic change, it is also possible that some of this increase could be attributable to testing a different population (e.g., workplace or long-term care facility) in response to a specific outbreak. Nonetheless, the week-over-week increase is worrisome.

Summary:

- Now that social distancing restrictions have been lifted, a greater frequency and intensity of human interaction will tend to facilitate viral spread. This tendency may be mitigated by individual actions including hand hygiene, mask wearing, and physical distancing.
- Reported cases, hospitalizations, and deaths have markedly diverged from previous trends; there is now compelling evidence (modelling and empiric) of increasing community transmission. Trends in Yuma, Maricopa, Pima, and Santa Cruz Counties appear to be driving much of this change (see Appendix).
 - Absolute levels of community-driven viral transmission remain high as evidenced by substantial numbers of newly reported cases.
 - For most locales, additional social distancing restrictions are urgently needed to reduce the pace of community transmission.
- Covid-related hospital utilization continues to increase with excess capacity declining from approximately 30% to <15% over the past two months. While adequate capacity exists, current trends in hospitalizations suggest excess capacity could be depleted by July.
 - Some hospitals have already warned that they are already nearing capacity including ICU care; therefore, local conditions will provide a better indicated of capacity than state-wide trends.
- The number of Covid-19 tests collected has remained relatively flat for the past 2 weeks, the PCR test positive rate remains >3% indicating capacity may not be adequate to meet clinical and public health demands, particularly in the face of accelerating community transmission. Test reporting lags continue threatening effective case identification and contact tracing efforts.

Next update scheduled for Jun 12.

Arizona Counties Outlook

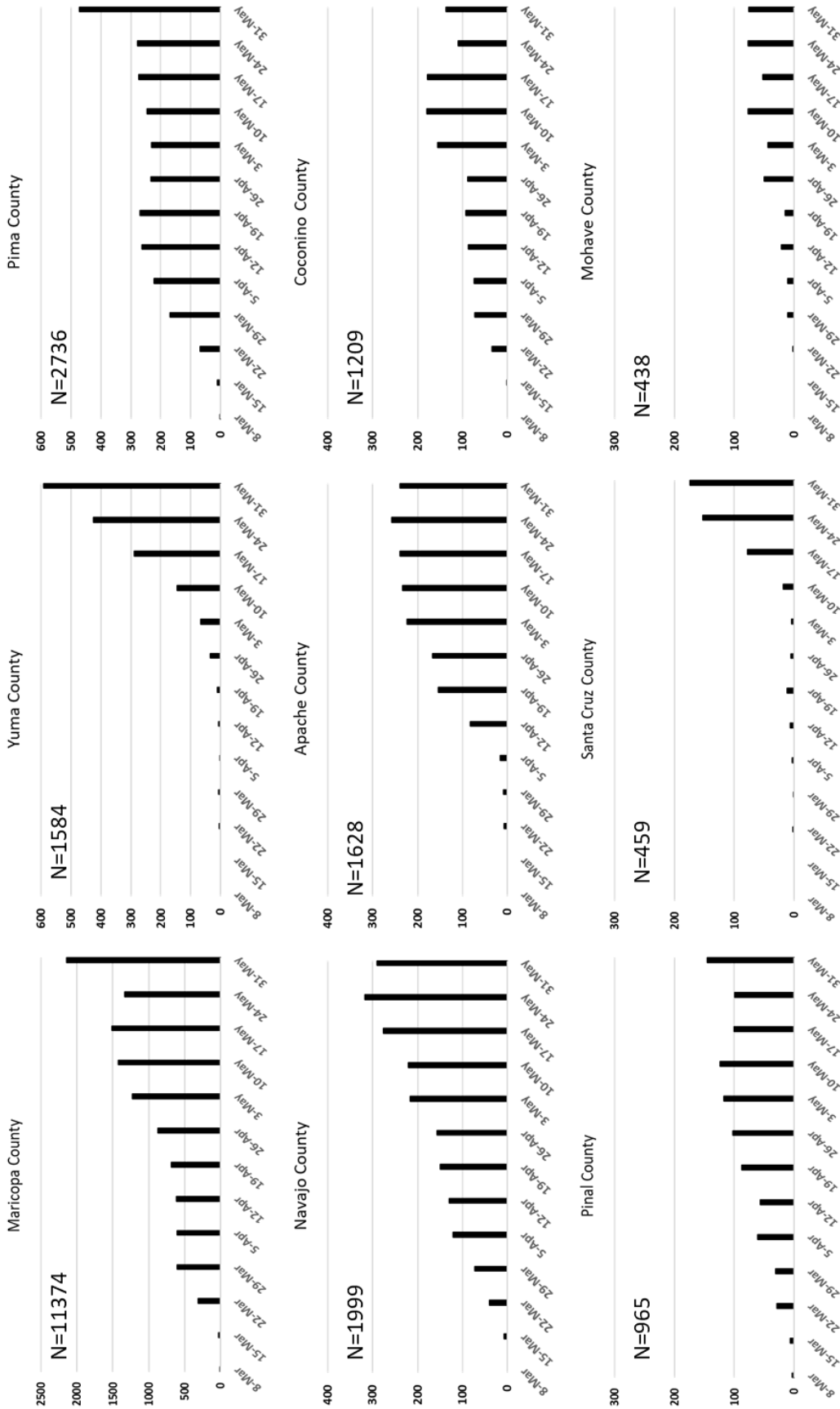


Figure 10. Weekly Covid-19 Case Counts across Arizona Counties with more than 305 Cases