

Covid-19 Disease Outbreak Outlook

Arizona State and Pima County

Updated November 20, 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. Updates can be accessed at <https://publichealth.arizona.edu/news/2020/covid-19-forecast-model>.

For the week ending November 15th, at least 18884 new Covid-19 cases were diagnosed in Arizona (Figure 1). This is a 28% increase from last week's initial tally of 14803 cases. Last week's tally was upwardly revised this week by 1011 cases, a 7% increase. Unlike this summer when delays were due to slow test reporting, the current delays lie elsewhere as 90% of results are reported within 3 days. Assuming similar amounts of backfill, this week's tally is likely to rise in the coming weeks by an additional 1 – 2 thousand cases meaning Arizona has once again crossed the 20,000 cases per week (3,000 per day) threshold. As reported previously, this outbreak continues to be broadly entrenched with rapid increases among all age groups (Figure 2 following page).

Note: Data for this report was updated mid-morning Friday, November 15 allowing 4 full working days to adjudicate weekend cases. This should reduce week-over-week backfill to <10% allowing more interpretable comparisons and graphics. All comparisons are week-over-week changes. Given the lengthy reporting delays, future updates will be released on Sundays.

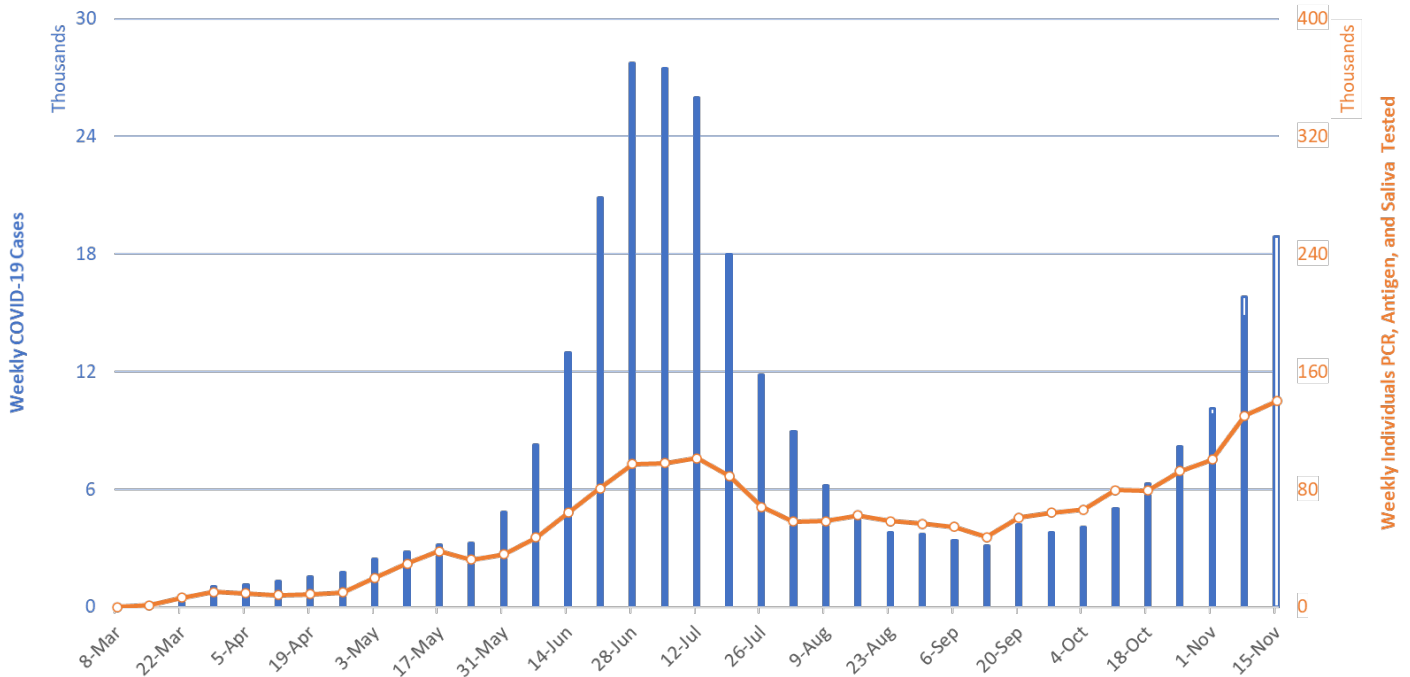


Figure 1. Newly Diagnosed Covid-19 Cases in Arizona and Number of Individuals Undergoing Covid-19 Diagnostic Testing March 1 through November 15.

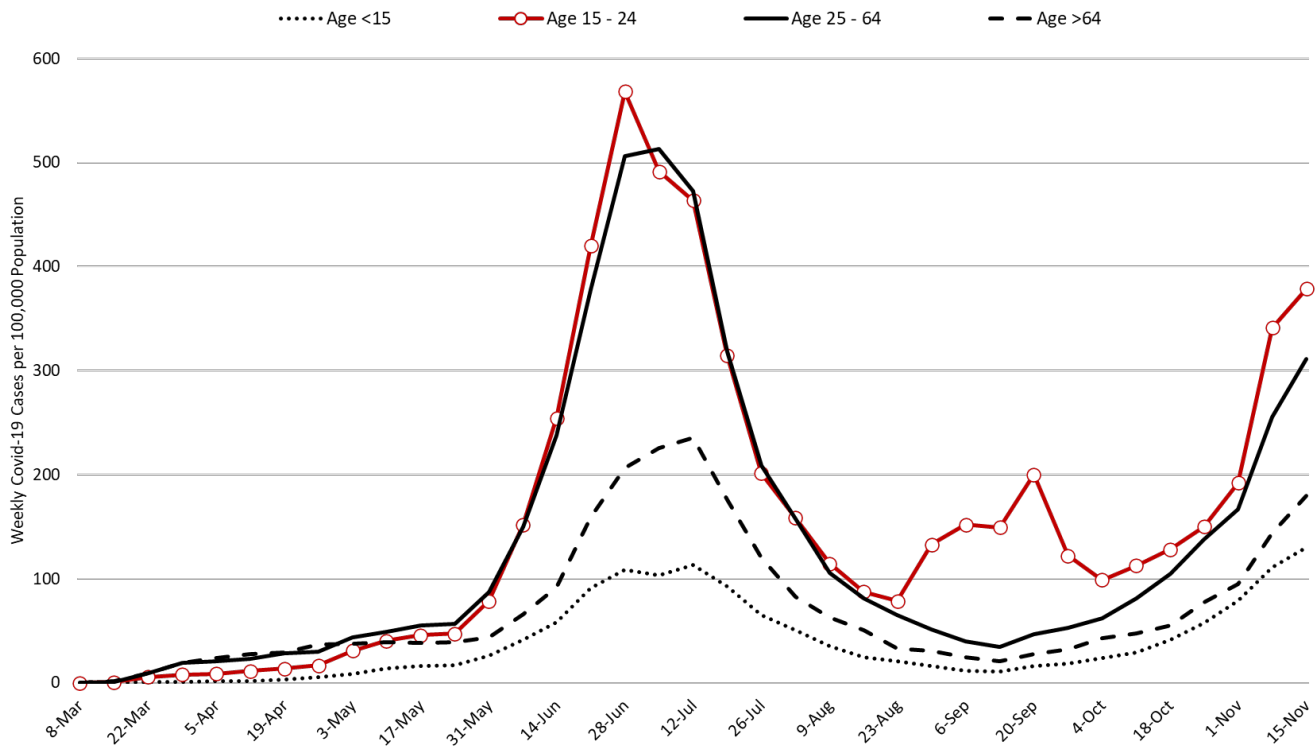


Figure 2. Newly Diagnosed Covid-19 Cases in Arizona by Age Group March 1 through November 15.

Test positivity among those undergoing traditional PCR testing continues to increase, reaching 16.0% this past week (Figure 3). Increasing test positivity provides additional evidence that viral transmission continues to increase despite the uncertainty surrounding actual case counts. Test positivity for antigen tests being conducted by the University of Arizona and by some long-term care facilities and retail clinics was 10.4% this week. Test positivity for saliva testing being conducted by Arizona State University for students and other groups was 8.7% this week.

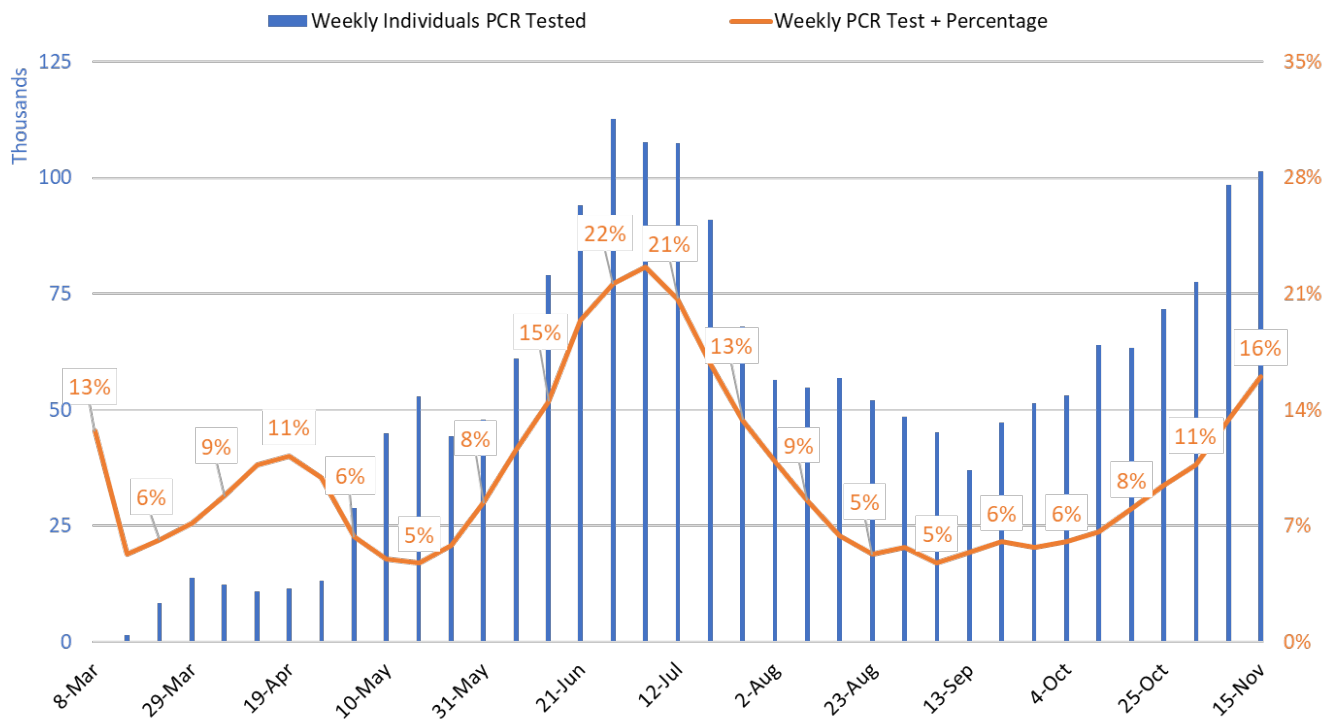


Figure 3. Weekly Number Patients PCR Tested and Percent with Positive Test March 1 – November 15.

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

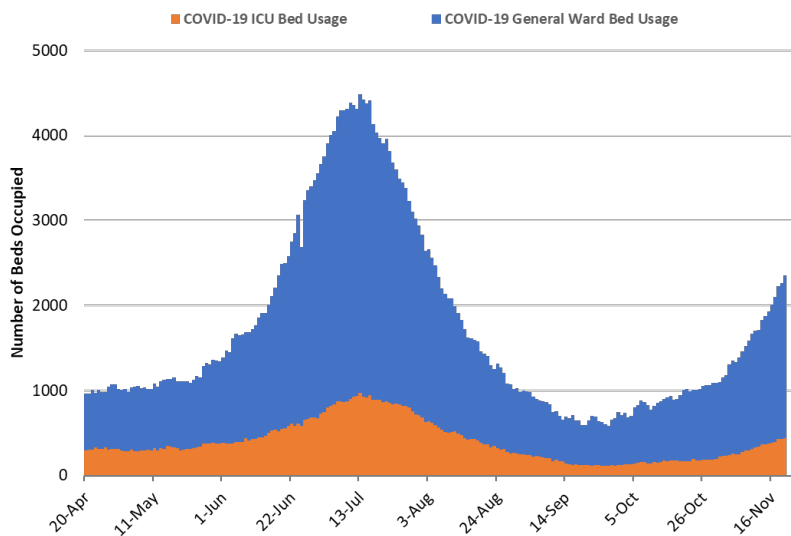


Figure 4. Arizona Daily Covid-19 General Ward and ICU Census April 20 – November 20.

As of November 20th, 1916 (22%) of Arizona’s 8648 general ward beds were occupied by Covid-19 patients, a 30% increase from last week’s 1470 occupied beds. An additional 944 (11%) beds remained available for use. This is lower than the 1051 beds available last week. The percentage of general ward beds occupied by patients with confirmed or suspected Covid-19 was 22.2% (Figure 5, panel A).

As of November 20th, 435 (25%) of Arizona’s 1731 ICU beds were occupied with Covid-19 patients, a 20% increase from last week’s count of 362 patients. An additional 174 (10%) ICU beds remain available. This is lower than last week’s 212 beds. The percentage of ICU beds occupied by patients with Covid-19 was 25.1% (Figure 5, panel B).

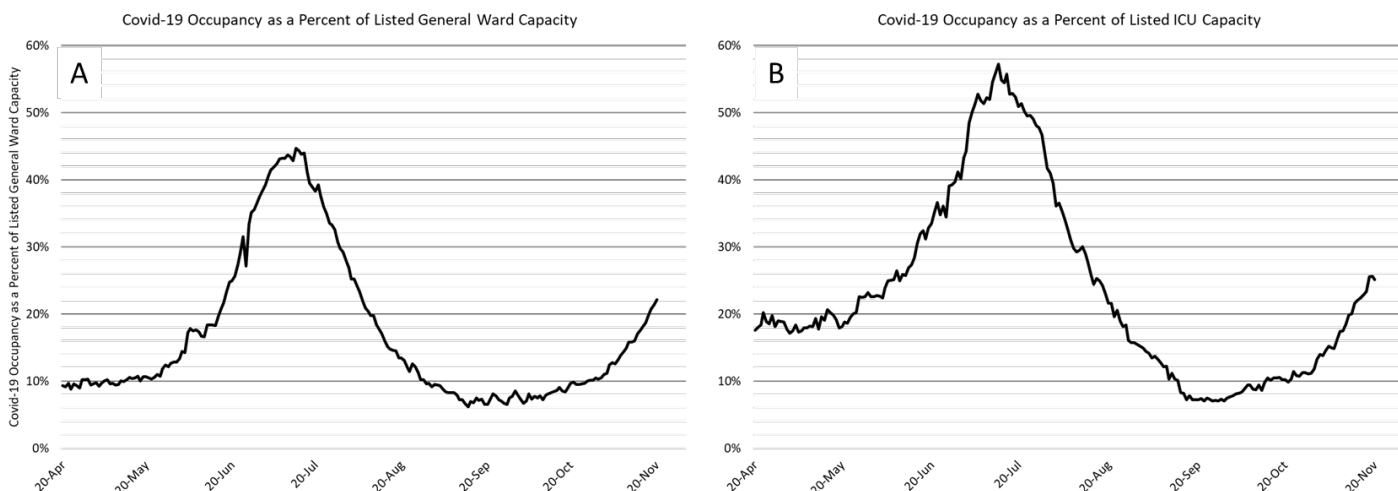


Figure 5. Covid-19 Occupancy as a Percent of Listed General Ward (A, left) and ICU (B, right) Capacity in Arizona April 20 – November 20.

Arizona hospitals’ safety margin continues to erode in both the ward and ICU (Figure 6, following page). For example, the lowest bed count during the summer outbreak occurred on July 10th when only 946 general ward beds were available. On November 20th, only 944 beds remained available. In the ICU, the nadir of available beds occurred on July 7th when there were only 145 available beds. On November 17th, 174 beds remained available. Hospital occupancy is high not only because of Covid-19 admissions but also because hospitals continue to perform scheduled procedures and because of higher occupancy this time of year due to wintering part-time residents and viral respiratory season.

While occupancy data suggest Arizona hospitals should be under greater strain, the fact that admissions are dispersed across multiple units, not just Covid-specific units, means the workload is more evenly distributed across physicians, nurses and other health professionals. As Covid-19 admissions continue to increase, this advantage will be lost.

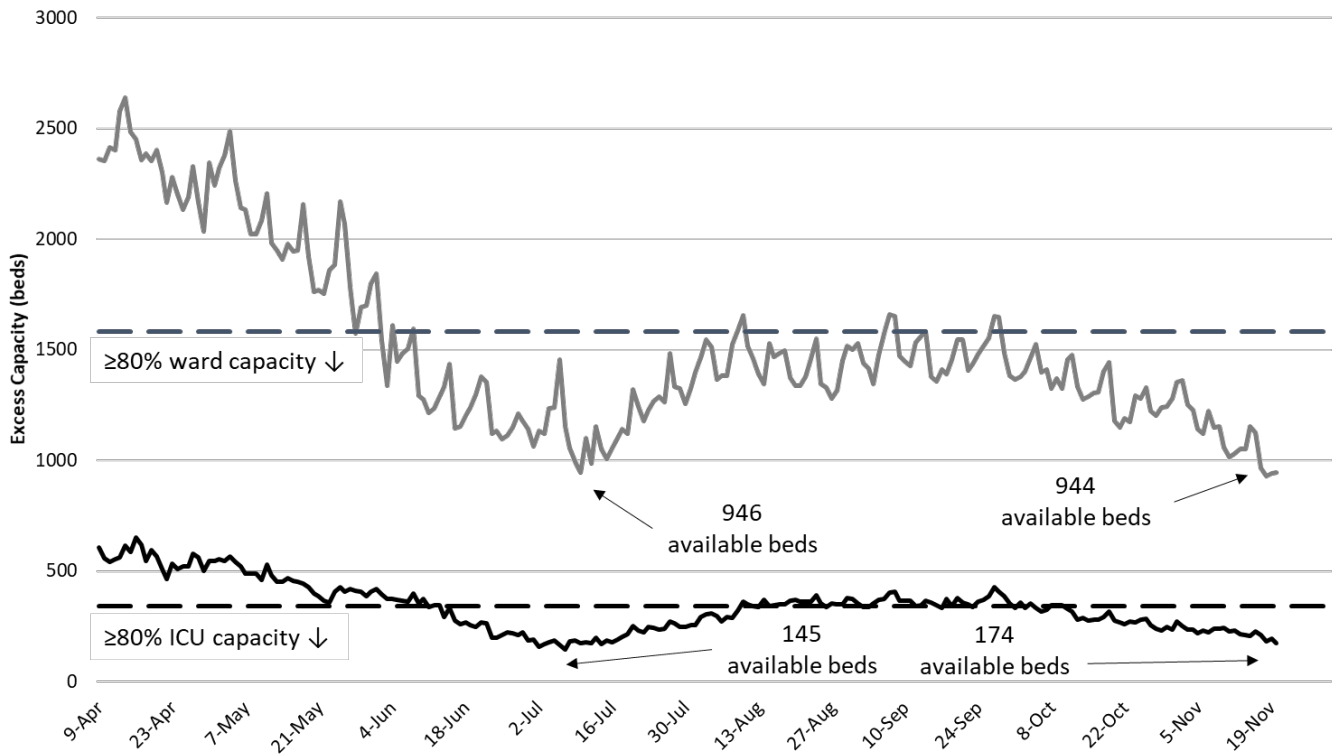


Figure 6. Observed Excess Non-Surge General Ward and ICU Capacity April 20 – November 20.

With 617 deaths, the week ending July 19th remains Arizona’s deadliest week (Figure 7). Weekly Covid-19 mortality reached a nadir of 46 deaths the week ending October 4th. Because cases have been increasing, deaths are now slowly trending up but remain below rates observed in May.

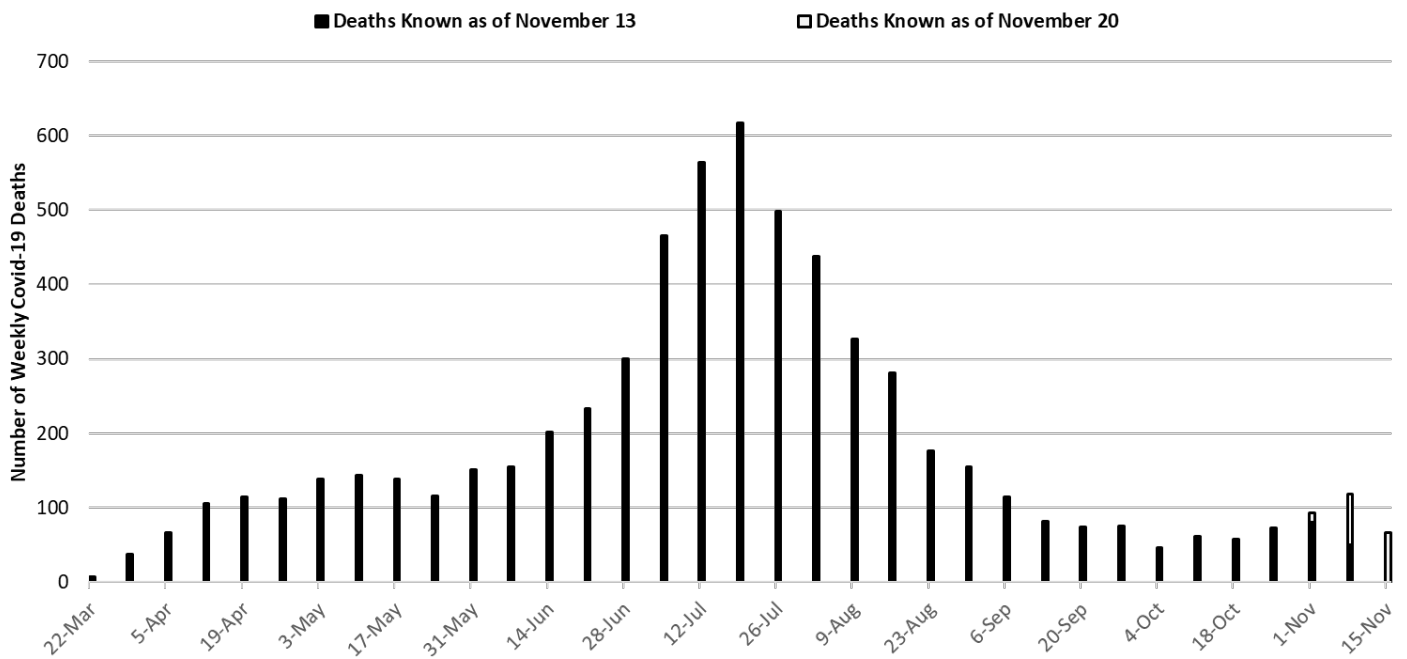


Figure 7. Weekly Known Arizona Covid-19 Deaths March 1 – November 15.

Pima County Outlook

For the week ending November 15th, 2624 Pima County residents were diagnosed with Covid-19 (Figure 8). This represents a 29% increase from the 2041 initially reported last week. This tally exceeds the prior record of 2477 cases observed the week ending July 5th. Test reporting remains relatively timely, but case reporting delays caused last week's initial tally of 2041 cases to be upwardly revised by 6% (117 cases) this week. Increases in viral transmission are occurring across all age groups (Figure 9).

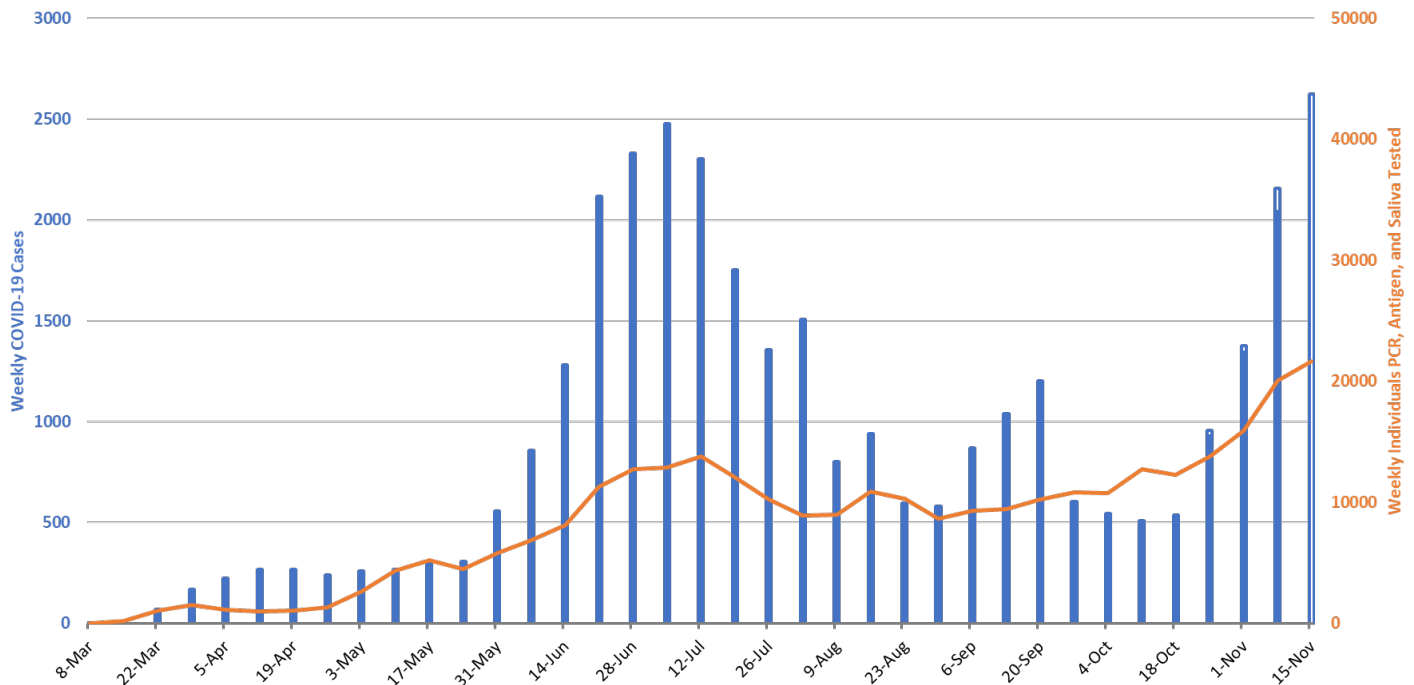


Figure 8. Covid-19 Cases and Individuals Undergoing Diagnostic Testing in Pima County Mar 1 – Nov 15.

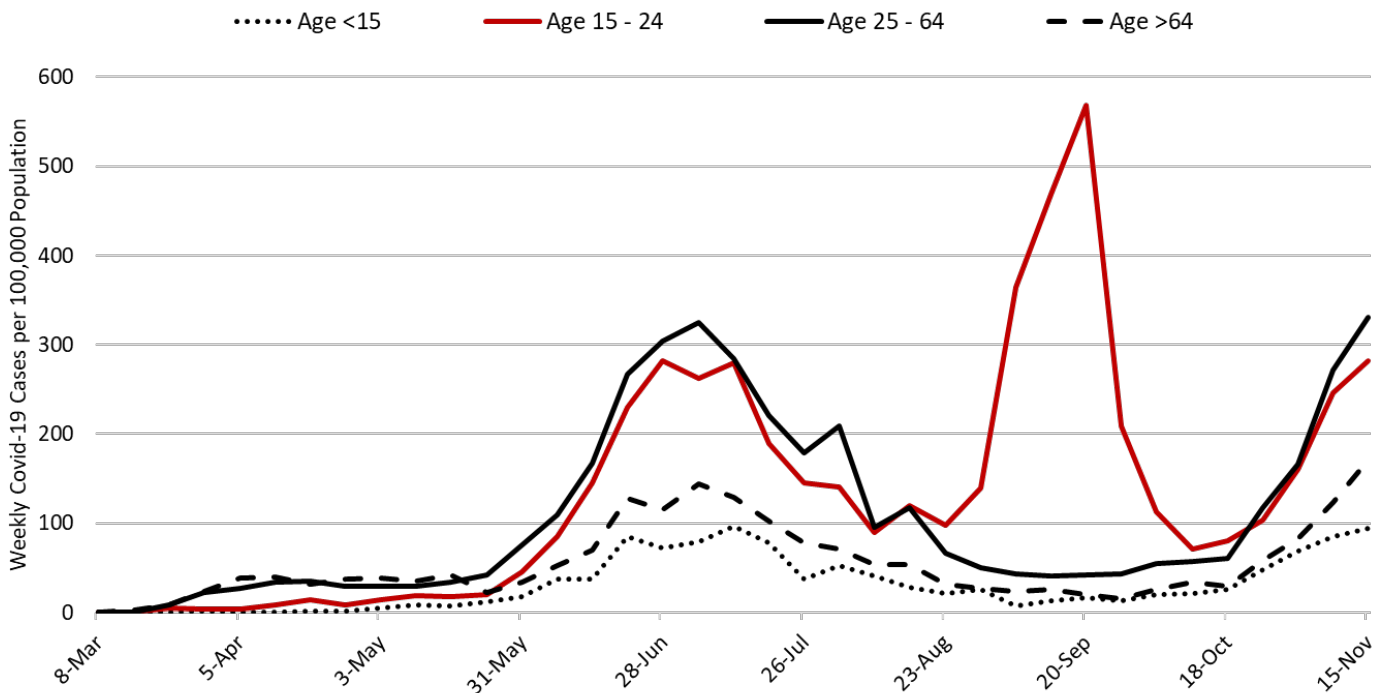


Figure 9. Covid-19 Cases by Age Group in Pima County from August 9 – November 15.

Updated Arizona State University Covid-19 Forecast

This week the ASU Covid-19 modeling group released a winter update that projects cases, hospitalizations, and deaths through mid-January ([full report](#)). Needless to say, the report is grim. While I summarize the main findings below, a few comments about methodology first.

They use a traditional epidemiologic SEIR model (susceptible, exposed, infected, recovered) augmented by a novel backcasting method to generate Arizona-specific estimates based on inferred transmission rates. A SEIR model “tracks” hypothetical individuals through the course of the epidemic based on known characteristics of the SARS-Cov-2 virus (e.g., incubation period, asymptomatic rate, etc.). The resulting outbreak curve describes how viral transmission would unfold in an immunological naïve population in the absence of mitigation efforts. This is essentially a worst-case scenario.

However, interventions like face coverings, physical distancing, and business closures can slow transmission rates and “flatten the curve.” To account for these efforts, their model estimates actual transmission rates based on observed Covid-19 deaths. These transmission rates are designated, β (Table 1). Using this method, they identified 3 distinct transmission periods: the post-opening surge from May to July, the post-face mask decline from July to September, and the University led fall resurgence from September to present. During these 3 periods, the respective transmission rates that fit the observed number of deaths were 0.230, 0.120, and 0.215, respectively.

Table 1: Model Transmission Rates

Period	Low	Best	High
May 15 – July 2		0.230	
July 3 – Sept 7		0.120	
Sept 8 – Nov 15		0.215	
Nov 16 – Jan 31	0.183	0.215	0.247

Moving forward, the ASU modeling group assumes 3 scenarios: current transmission rates remain unabated ($\beta = 0.215$), transmission accelerates ($\beta = 0.247$), or transmission declines ($\beta = 0.183$). The team’s best estimate assumes that transmission will continue unabated as there has been no change in behavior or policy to suggest other outcomes are more plausible. The low and high assumptions simply reflect arbitrary potential deviances around their best-fit estimate. Their results for Maricopa County are shown in Figure 10.

Assuming current viral transmission rates continue unabated, total Covid-19 hospitalizations in **Maricopa County** will not exceed their prior July 2020 peak until early 2021. However, it should be noted that the same number of Covid-19 hospitalizations will have a greater impact on hospital occupancy this winter owing to higher demand. If the transmission rate is actually 15% higher than estimated, the prior peak could be reached by Christmas. If it is lower, then hospitalizations will never reach the former peak.

For some perspective, the orange dots in Figure 10 represent actual Covid-19 hospitalizations in Arizona through early November. The outbreak curve produced by the model fits the actual values quite closely.

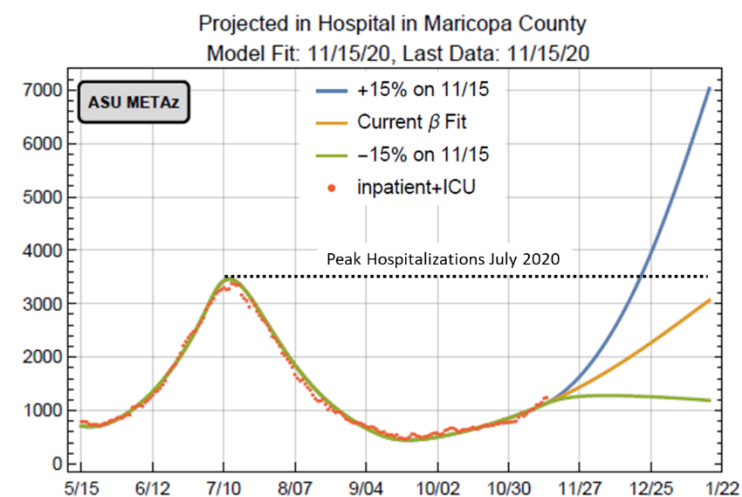


Figure 10. ASU Covid-19 Modeling Group Estimate of Hospitalization in Maricopa County through January 21st.

Because traditional holiday travel and gatherings pose a risk of increasing viral transmission, the ASU modeling group has modeled two potential scenarios based on reports of the Canadian experience during their holiday season which preceded ours. The first reflects a short-lived 45% increase in viral transmission for 6 days (November 24 – 29) after which it returns to the pre-holiday baseline. The second reflects the initial short-lived 45% increase followed by a smaller 23% increase during the Christmas – New Years holidays (December 21 – January 6).

Under these assumptions, viral transmission increases leading to an even greater number of hospitalizations. For these projections, the modeling group estimates **Arizona** will exceed its prior peak hospitalizations mid-December to early January (Figure 11). Again, the same caution: at the same number of Covid-19 hospitalizations will lead to higher occupancy in January than in July.

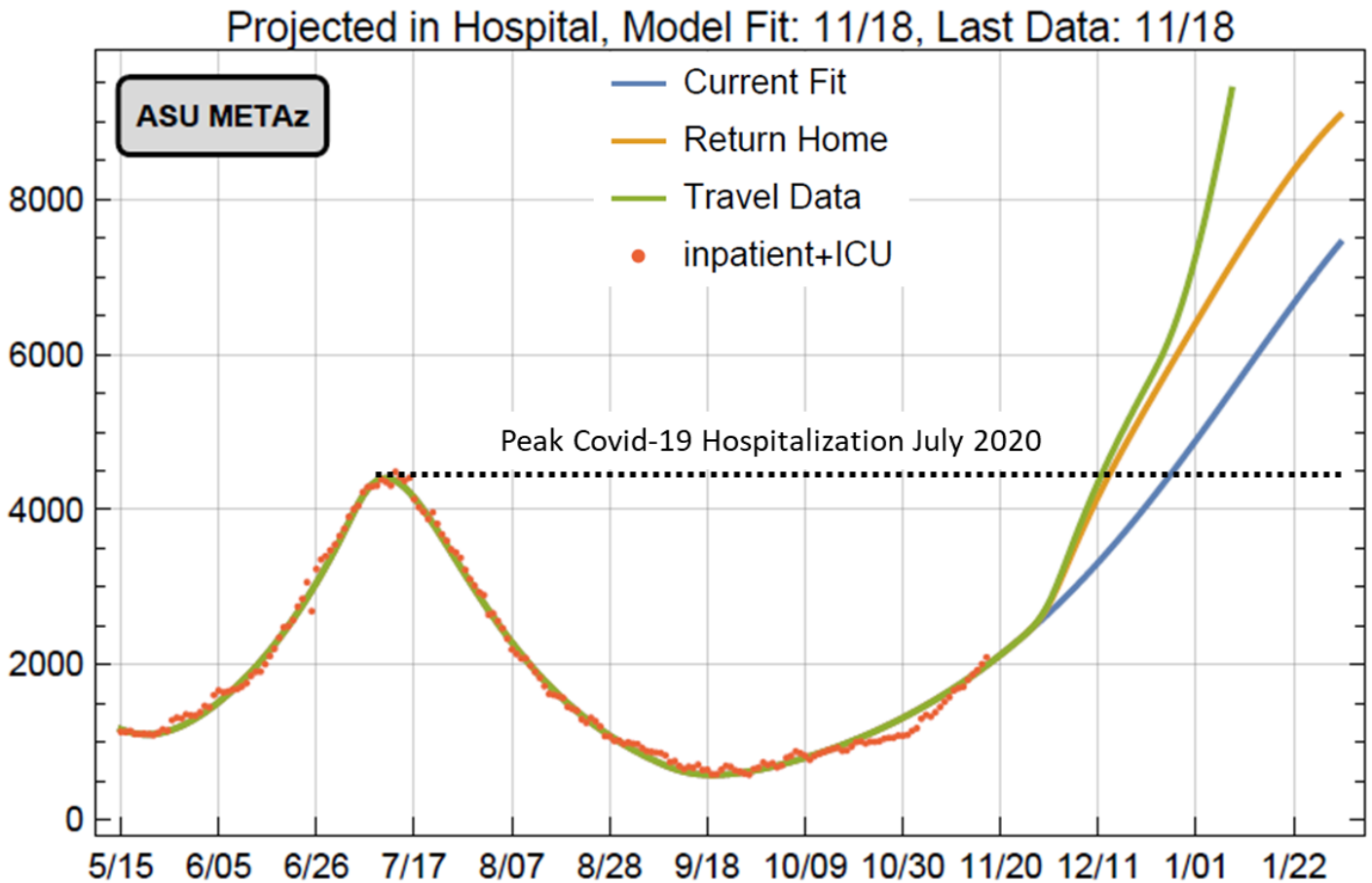


Figure 11. ASU Covid-19 Modeling Group Estimate of Total Covid-19 Hospitalization in Arizona through January 21st. Produced by Esma Gel, PhD, Megan Jehn, PhD, Anna Muldoon MPH, Health Ross, PhD, DNP, ANP-BC, and Tim Lant, PhD, MAS.

**A special thank you to the members of the ASU Covid-19 Modeling Group for their efforts to bring greater understanding of the current outbreak and for sharing their report. Readers are encouraged to read the full report which can be found [here](#).

Summary:

- Viral transmission continues to increase unabated. If not quickly addressed, new Covid-19 cases will overwhelm our capacity to provide optimal hospital care within a matter of weeks. A few weeks after this, hospitals throughout Arizona will reach maximum occupancy.
 - New cases are currently being diagnosed at a rate of at least 264 cases per 100,000 residents per week. This rate is increasing by approximately 54 cases per 100,000 residents per week.
 - The following counties have set new weekly Covid-19 case records since the July outbreak: Pima, Coconino, Cochise, Apache, Yavapai, Gila, Graham and Greenlee counties.
- Mask-wearing ordinances will be needed for the foreseeable future to mitigate the spread of Covid-19. Additional measures are urgently needed to address “quarantine fatigue” and other lapses in mitigation.
 - Large, social gatherings should be avoided.
 - When possible, residents should avoid prolonged contact in indoor spaces where physical distancing is not adequate and adherence to face masks is low.
 - Elected officials, community leaders, and businesses should model these behaviors, encourage others to follow suit, and enforce penalties for those who do not.
- Hospital occupancy is increasing due to Covid-19 transmission. Our current safety margin is eroding and could exceed the previously July peak as early as late December.
 - The fall-winter viral respiratory season plus the return of part-time residents who winter in Arizona will place increasing strain on our hospitals through January.
 - Holiday travel and social gatherings between Thanksgiving and New Years are likely to increase transmission levels even faster than current rates.
 - If current trends continue, Arizona is on track to experience a major crisis during the Thanksgiving – Christmas – New Year holiday season.
- While Covid-19 test results continue to be returned in a timely manner, case reporting delays are making it difficult to accurately measure trends in viral transmission.
- The test positive rate for traditional PCR testing continues to increase, reaching 16% this week. The growing mismatch between testing capacity and demand indicates viral transmission is growing faster than the estimates provided in this update.
- Covid-19 mortality continues to increase, but rates remain lower than those observed with this summer’s outbreak.
 - Avoiding cases among those ≥ 65 years of age, particularly those residing in long-term care facilities, is critical to keeping mortality low. For example, [LTC residents in Pima County](#) have accounted for <5% of the county’s cases but about 14% of hospitalizations and 39% of deaths.

Next update scheduled for November 27.

County data appear in Appendix.

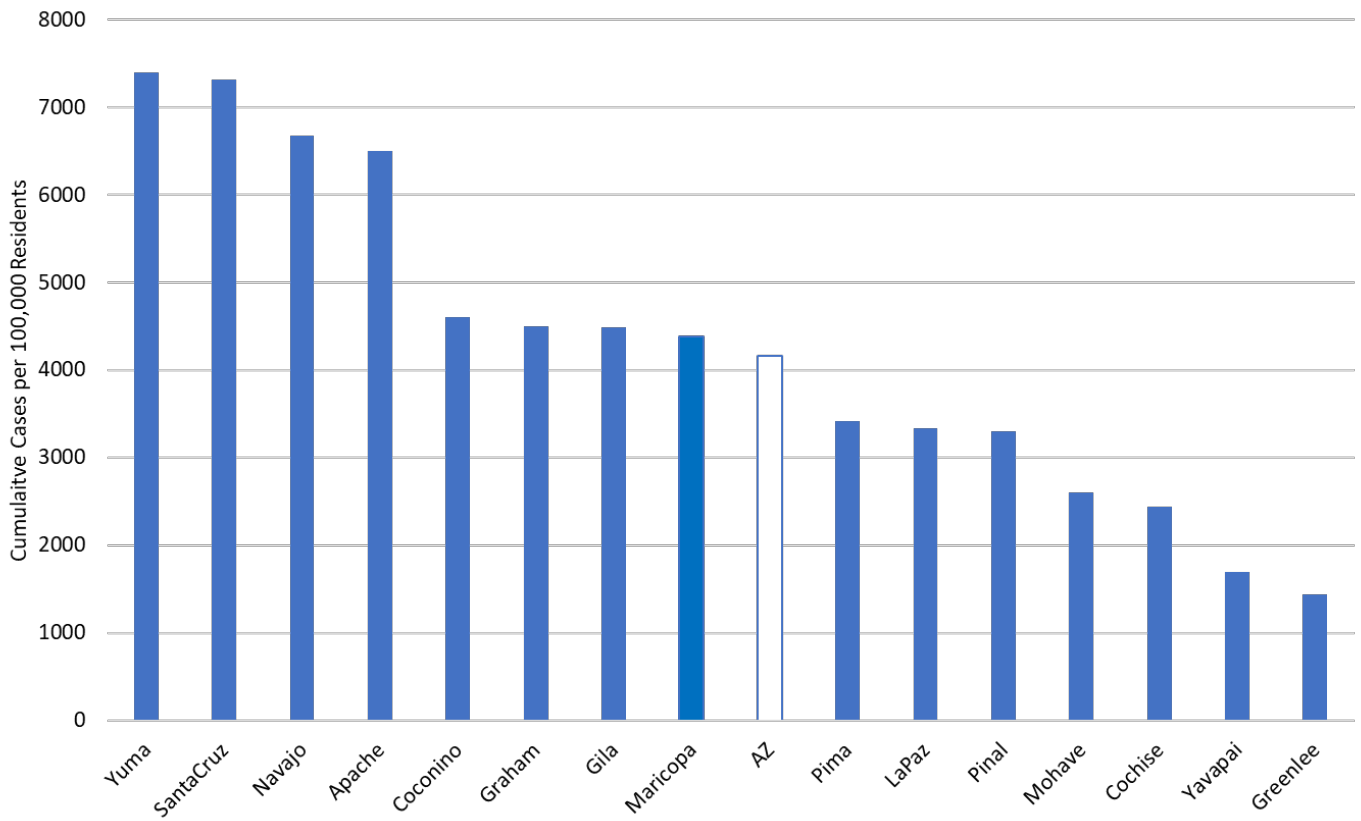


Figure 1A. Cumulative Covid-19 Incidence in Arizona by County March 1 – November 15.

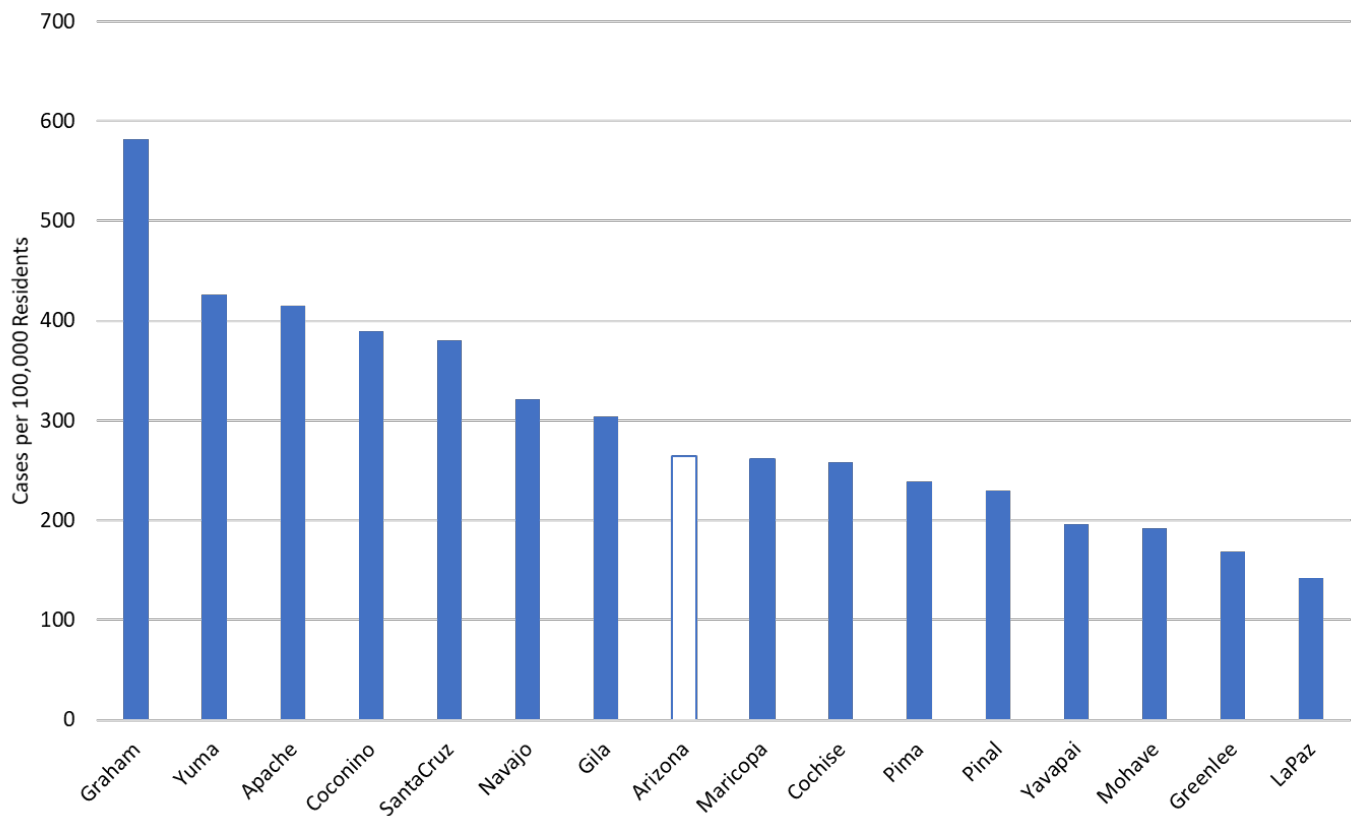
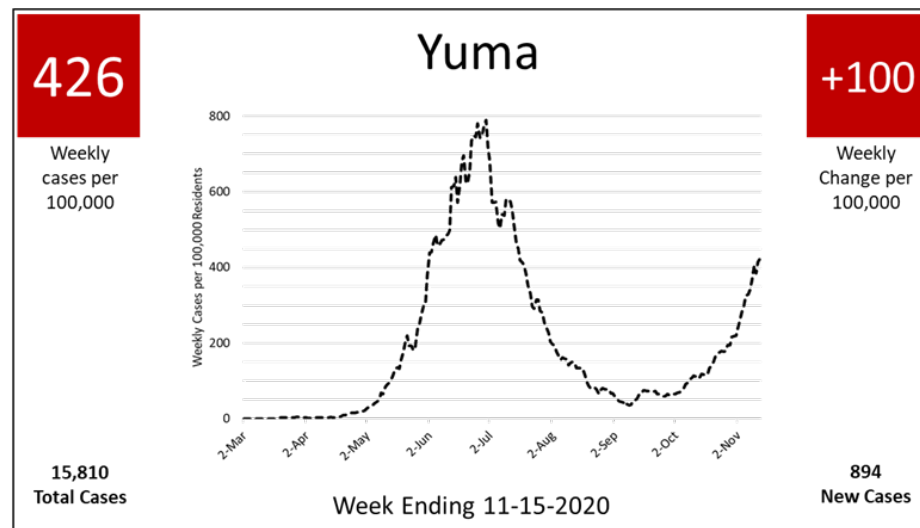
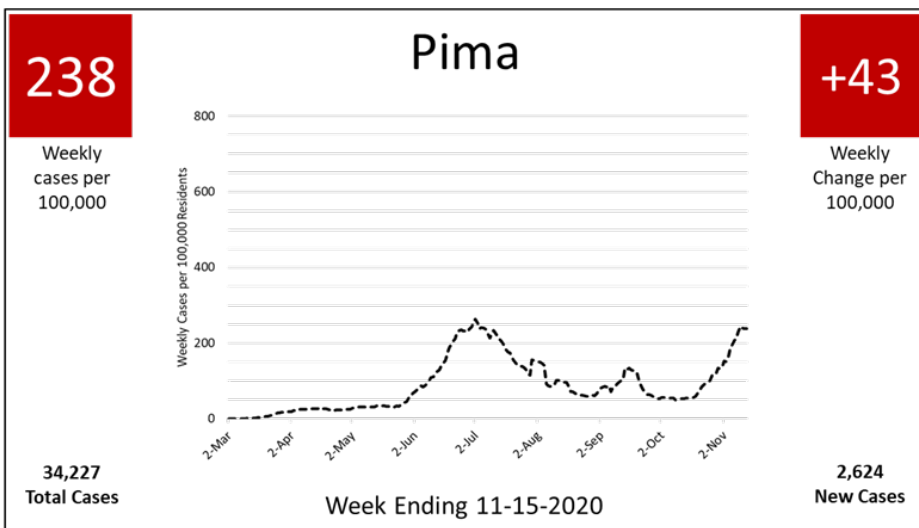
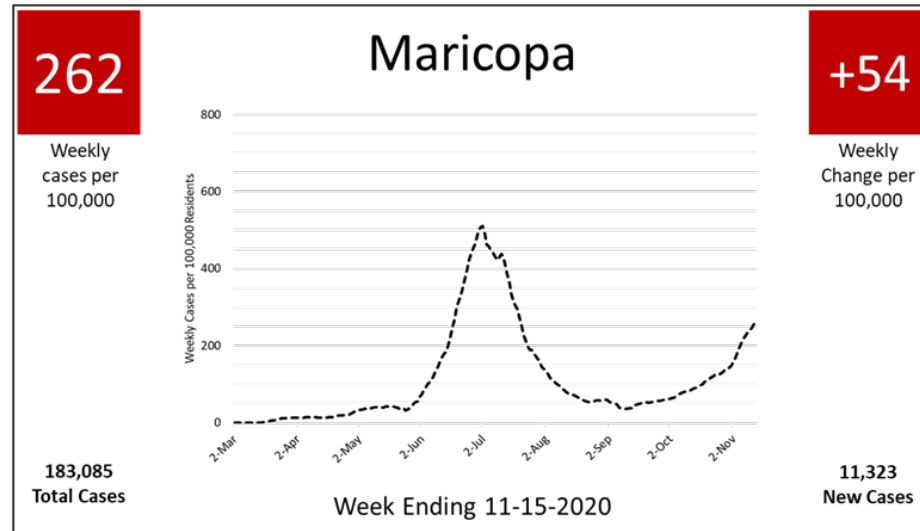
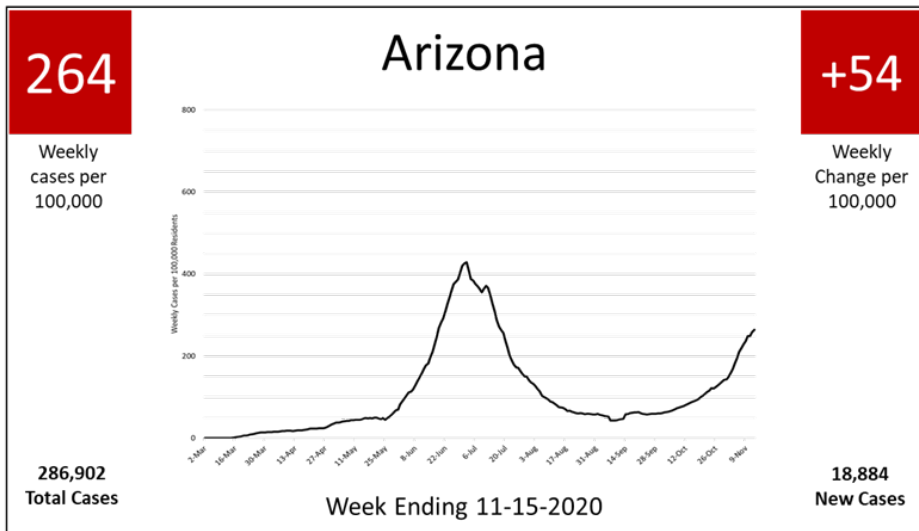
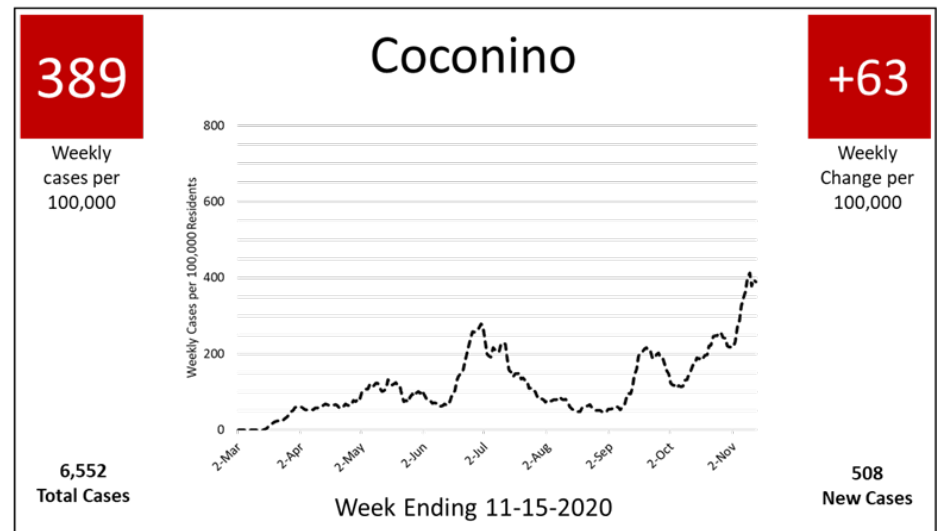
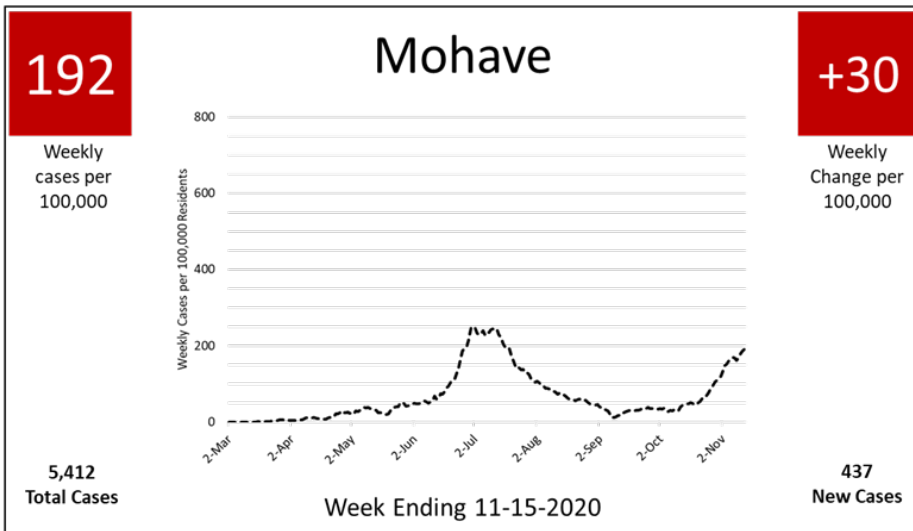
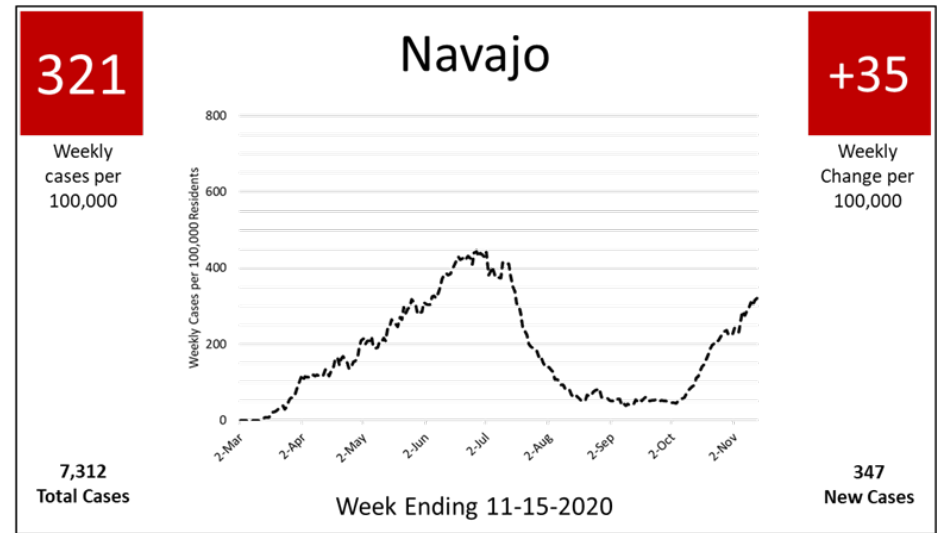
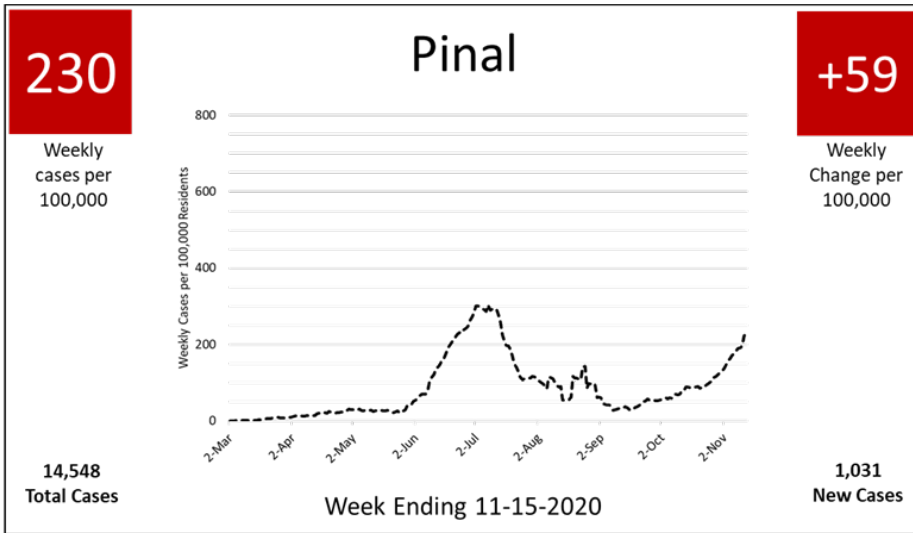


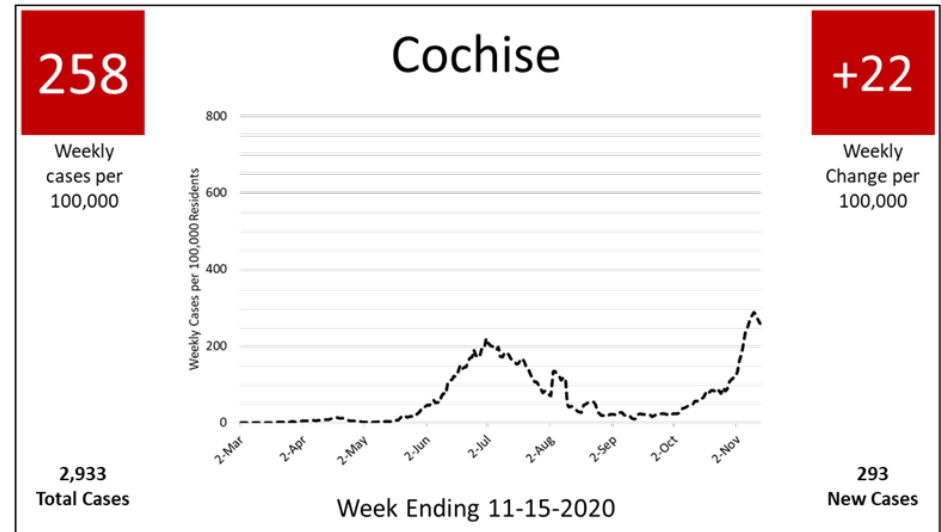
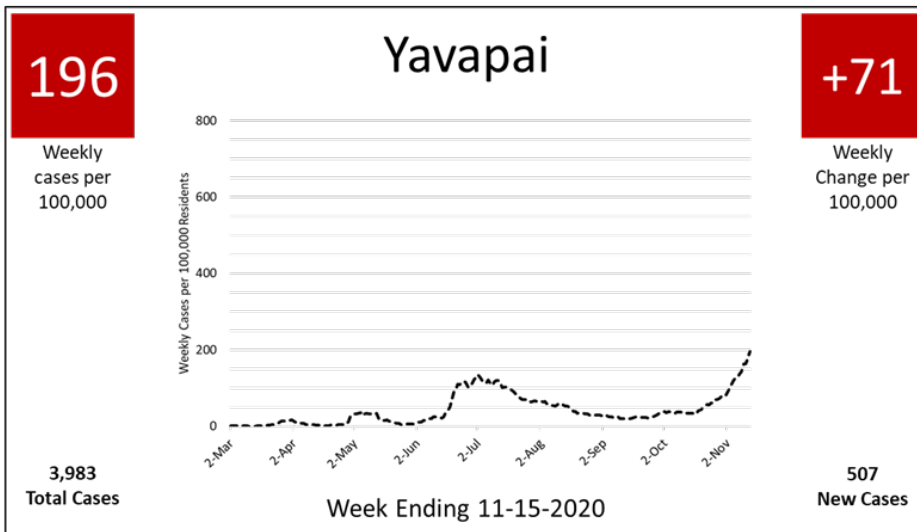
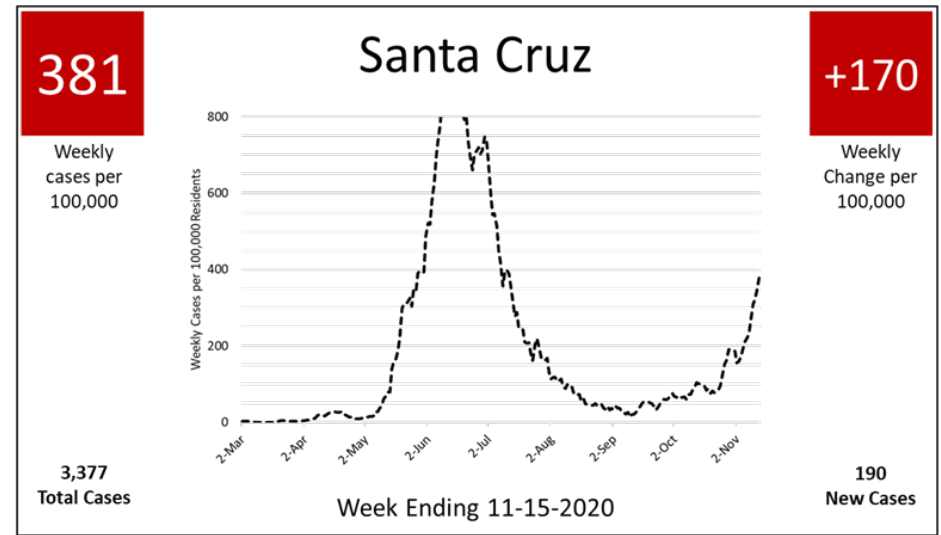
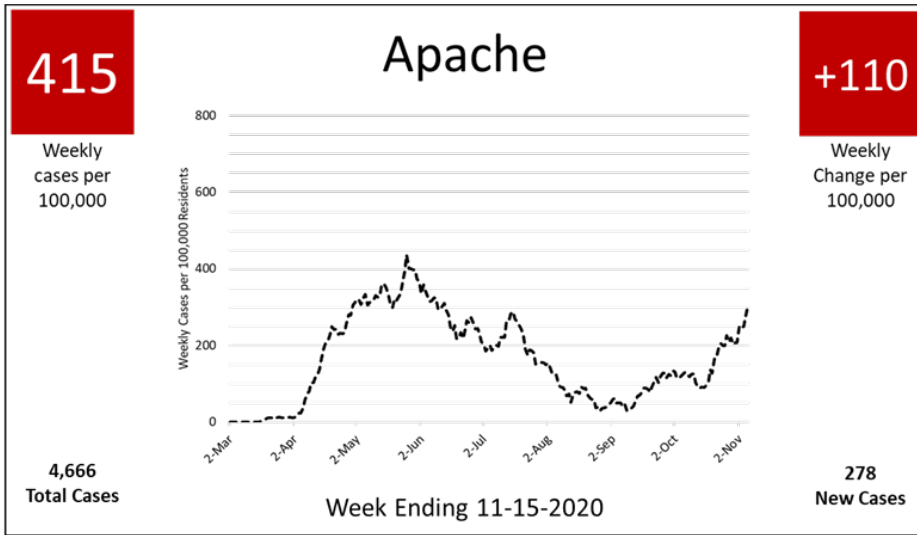
Figure 2A. Covid-19 Weekly Cumulative Incidence in Arizona by County October 18 – November 15.



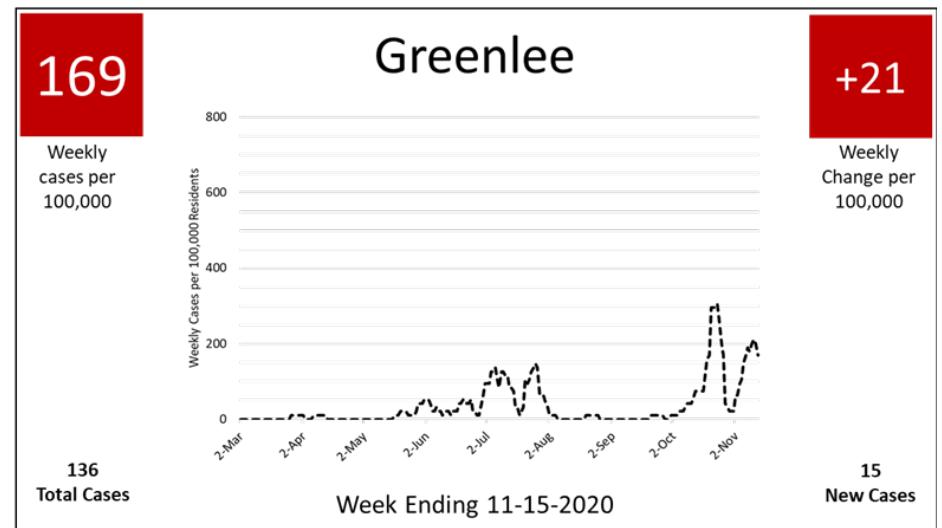
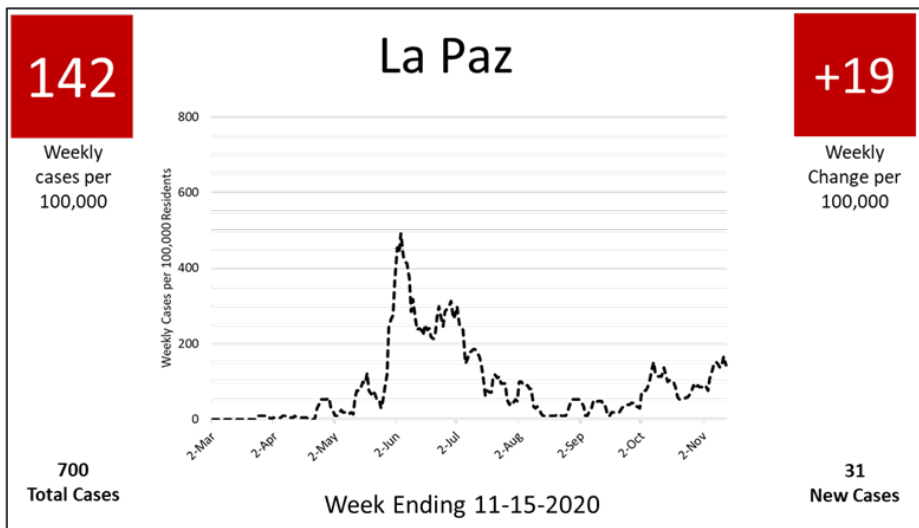
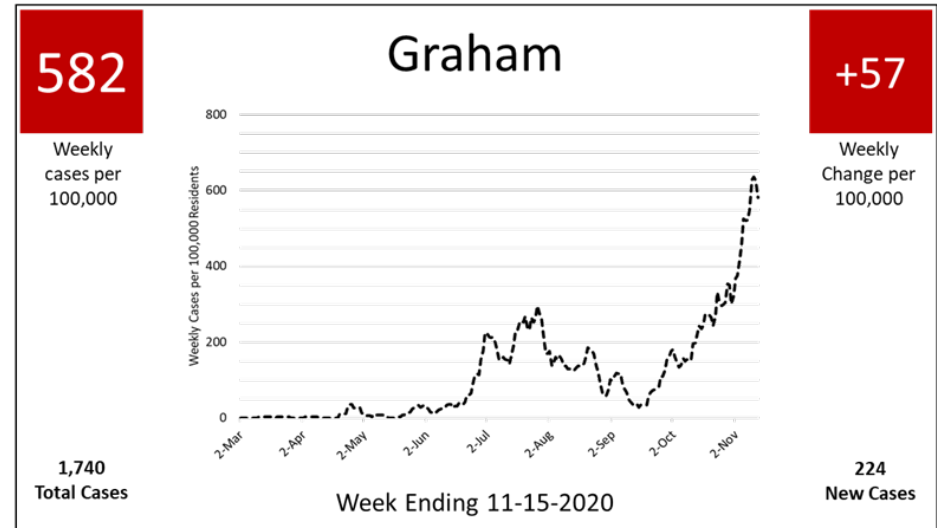
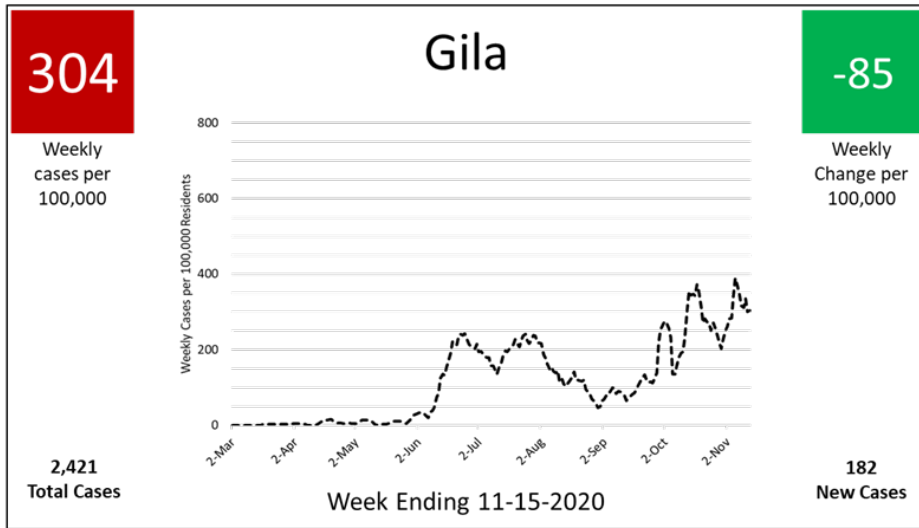
Appendix Figure 3A. Weekly Covid-19 Case Rates and Week-to-Week Change per 100,000 Population by County March 1 – November 15 (Green shading represents a case rate <100 per 100,000 per week or a declining week-to-week change).



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