COVID-19 Modeling Update for Arizona and Maricopa County

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These projections are not intended to be predictions or quantitative guesses about what will actually happen in the mid-range (weeks-to-months) or long-term (months-to-years). They are intended to show current trends projected into the future and the relative effects of changes in transmission, social distancing, weather sensitivity, current burden of disease, and other epidemiological factors. As more testing, tracing, and isolation come online and policies/behaviors change, the estimates will change.
Model Data
AZ Central Region Hospitalizations

- We see a sustained increase in hospital admissions in both inpatient and ICU beds, as well as a sustained increase in ED visits.
- Potential data bias is high in several categories: reporting delays, changes in policy, system capacity constraints.

![Graph showing patients at Central Region Hospitals, 11/15/20](image)

Pre-publication. Results subject to peer-review.
Maricopa County Projections*

* Maricopa County projections were recently completed on 11/15 so we share them here to inform travel insights.
Key Drivers of Transmission Estimates

• Fluctuation in daily testing volume and amount of undetected cases is still unknown.
• Reporting lags in cases have decreased considerably since July, but are now increasing.
• Hospitalizations and deaths are trailing indicators and lead to underestimating the severity of current outcomes.
• SARS-CoV-2 is an overdispersed pathogen and therefore transmission is not homogenous; however, existing test-trace-isolate programs are insufficient to characterize transmission. As a result, population level dynamics are still relevant despite homogenous mixing assumptions.
• Data from 15 states suggests state mandates around mask wearing are correlated with lower levels of daily COVID-19 growth rate (Lyu and Webhy, Health Affairs). This is consistent with data from Maricopa County showing a 35% reduction in transmission after the county mask mandate.
Basic Assumptions:

• We assume that transmission will continue at the current transmission rate, $\beta$, estimated from Maricopa County data.
• We do not assume any specific changes in policy or physical distancing behaviors.
• We project ‘high’ and ‘low’ estimates assuming a 15% increase and 15% decrease in transmission with historical estimates for disease severity and outcomes.
• We searched for the best date range to fit a new transmission rate for Maricopa: ~Sept 7, 2020
Scenarios

Scenario +15% - High

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Scenario Current Fit

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Scenario -15% - Low

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Key dates:

- 5/15 – reopening and end of Stay-at-Home order
- 6/20 – delegation of authority to local governments and passage of mask ordinances
- We have observed that transmission rates were impacted by the mask update around 7/2
- Efforts to fit data to hospitalizations, ICU and deaths tend to indicate transmission rate increase around 9/7
Projections for Total Infectious Persons in Maricopa

Projected Total Infectious Persons in Maricopa County
Model Fit: 11/15/20

- Blue line: +15% on 11/15
- Orange line: Current β Fit
- Green line: −15% on 11/15

Pre-publication. Results subject to peer-review.
Hospitalization Projections in Maricopa

Projected in Hospital in Maricopa County
Model Fit: 11/15/20, Last Data: 11/15/20

Pre-publication. Results subject to peer-review.
Projections for ICU Usage

Projected in ICU in Maricopa County
Model Fit: 11/15/20, Last Data: 11/15/20

- +15% on 11/15
- Current β Fit
- −15% on 11/15
- daily ICU census

Pre-publication. Results subject to peer-review.
Projections for Cumulative Deaths in Maricopa

Single mortality rate does not reflect the changes in age distributions over time. We expect to see increases to the published deaths by incident date data, most likely improving fit.
Projections for Total Recovered in Maricopa

Projected Fraction Recovered in Maricopa County
Model Fit: 11/15

Pre-publication. Results subject to peer-review.
Holiday Travel Assumptions
Thanksgiving Travel

• ~1 million Arizonans are estimated to be traveling >50 miles for the 2020 Thanksgiving holiday¹.
• ~2 million Arizonans are estimated to be traveling <50 miles for celebrations².
• Therefore, we anticipate that more than 50% of Arizonans will be participating in gatherings with non-household contacts over non-Thanksgiving weeks.
• We assume the Thanksgiving travel increases non-household close contacts.

Scenarios for the Holidays

• Return Home –
  • We assume a 45% increase based on the increase in the 7-day average of confirmed cases\(^1\) from Canadian Thanksgiving applied over the 6 days of US Thanksgiving travel shown by the Bureau of Transportation Statistics\(^2\).
  • Families do not travel for winter holidays and students remain at home after Thanksgiving travel.

• Travel Data –
  • 54% average increased travel over the mean for Thanksgiving for 6 days\(^2\)
  • 23% average increased travel over the mean for winter holidays 17 days\(^2\)

• Current Fit –
  • No change in transmission due to holiday travel.


Return Home Scenario

• Assumptions:
  • Canadian experience of a 45% increase after the holiday is transferrable to US.
  • BTS data showing 6 days of increased travel transfers to 2020 holidays.
  • Families return to normal contact patterns and transmission after Thanksgiving and do not travel for winter holidays.
  • No other interventions to reduce or increase transmission after Thanksgiving.

• Transmission Increase
  • 45% for the period of Nov 24-Nov 29
Travel Data Scenario

- Assumptions:
  - Seasonal increases in holiday travel remain consistent with previous years despite COVID-19.
  - Length of travel periods remains the same
  - Increases in travel equate to increases in contacts and thus increases in transmission.
  - No additional public health measures or restrictions on travel come into effect between Thanksgiving and winter holidays

- Transmission increase:
  - 54% Nov 24 – Nov 29
  - 23% Dec 21 – Jan 6
Maricopa County Holiday Scenarios
Projected Total Infectious Persons in Maricopa County
Model Fit: 11/15/20

ASU META

Current Fit
Return Home
Travel Data

Pre-publication. Results subject to peer-review.
Projected in Hospital in Maricopa County
Model Fit: 11/15/20, Last Data: 11/15/20

- Current Fit
- Return Home
- Travel Data
- inpatient+ICU

Pre-publication. Results subject to peer-review.
Projected in ICU in Maricopa County
Model Fit: 11/15/20, Last Data: 11/15/20

ASU METAz

Current Fit
Return Home
Travel Data
• daily ICU census

Pre-publication. Results subject to peer-review.
Projected Cumulative Deaths in Maricopa County,
Model Fit: 11/15/20, Last Data: 11/15/20

ASU METAz

Current Fit
Return Home
Travel Data
● deaths by incident date

Pre-publication. Results subject to peer-review.
Arizona Statewide Holiday Scenarios
Projected Total Infectious Persons, Model Fit: 11/18

- Current Fit
- Return Home
- Travel Data

Pre-publication. Results subject to peer-review.
Projected in Hospital, Model Fit: 11/18, Last Data: 11/18

Projected data showing trends in hospital stays, fitting models, and travel data. The graph includes lines representing current fit, return home, travel data, and inpatient+ICU.
Projected in ICU, Model Fit: 11/18, Last Data: 11/18

- Current Fit
- Return Home
- Travel Data
- daily ICU census

Pre-publication. Results subject to peer review.
Projected Cumulative Deaths, Model Fit: 11/18, Last Data: 11/18

- **Current Fit**
- **Return Home**
- **Travel Data**
- **deaths by incident date**

Pre-publication. Results subject to peer-review.
Hospital Utilization Projections
Arizona will likely surpass the prior July peak of hospital beds occupancy with COVID-19 patients as soon as December 28 with holiday travel and by the third week of January with current transmission and no increase in holiday travel.
Central Region: % Hospital Capacity In occupancy by COVID-19 patients

Pre-publication. Results subject to peer-review.
Arizona will likely surpass the prior July peak of ICU COVID-19 patients as soon as December 18 with holiday travel and by mid-January with current transmission and no increase in holiday travel.
Conclusions
The current hospital and ICU estimates indicate that hospital capacity could be reached as soon as 12/13 and 12/22 respectively with no additional mitigations to reduce community transmission.

Without additional interventions and mitigation, the latest we expect hospital and ICU capacity to be reached is 12/31 and 1/11 respectively.
Implications

- Based on the amount of community spread we are seeing now, combined with expected increases related to Thanksgiving travel and celebrations with household mixing, current hospital capacity will be exceeded in December.
- Additional emergency public health interventions will be necessary to control transmission and preserve healthcare capacity in Arizona including a state-wide mask mandate, preventing gatherings of more than 10 people, closing bars, and decreasing capacity restrictions at restaurants with effective enforcement.
- Without additional public health measures, holiday gatherings are likely to cause 600-1,200 additional deaths from COVID-19 in Arizona by February 1 beyond current scenario death projections.
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