Arizona State University

COVID-19 Modeling Update

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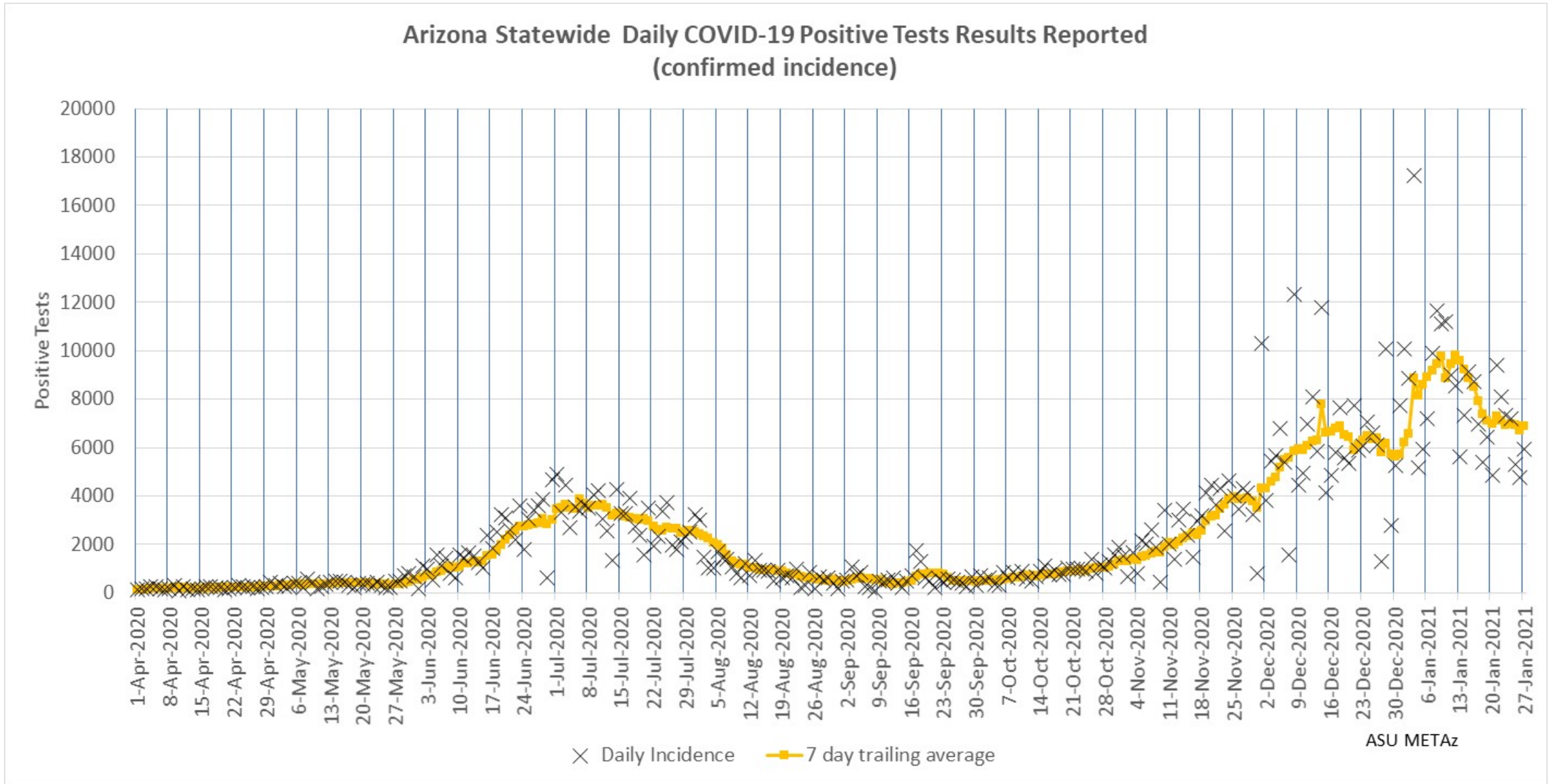
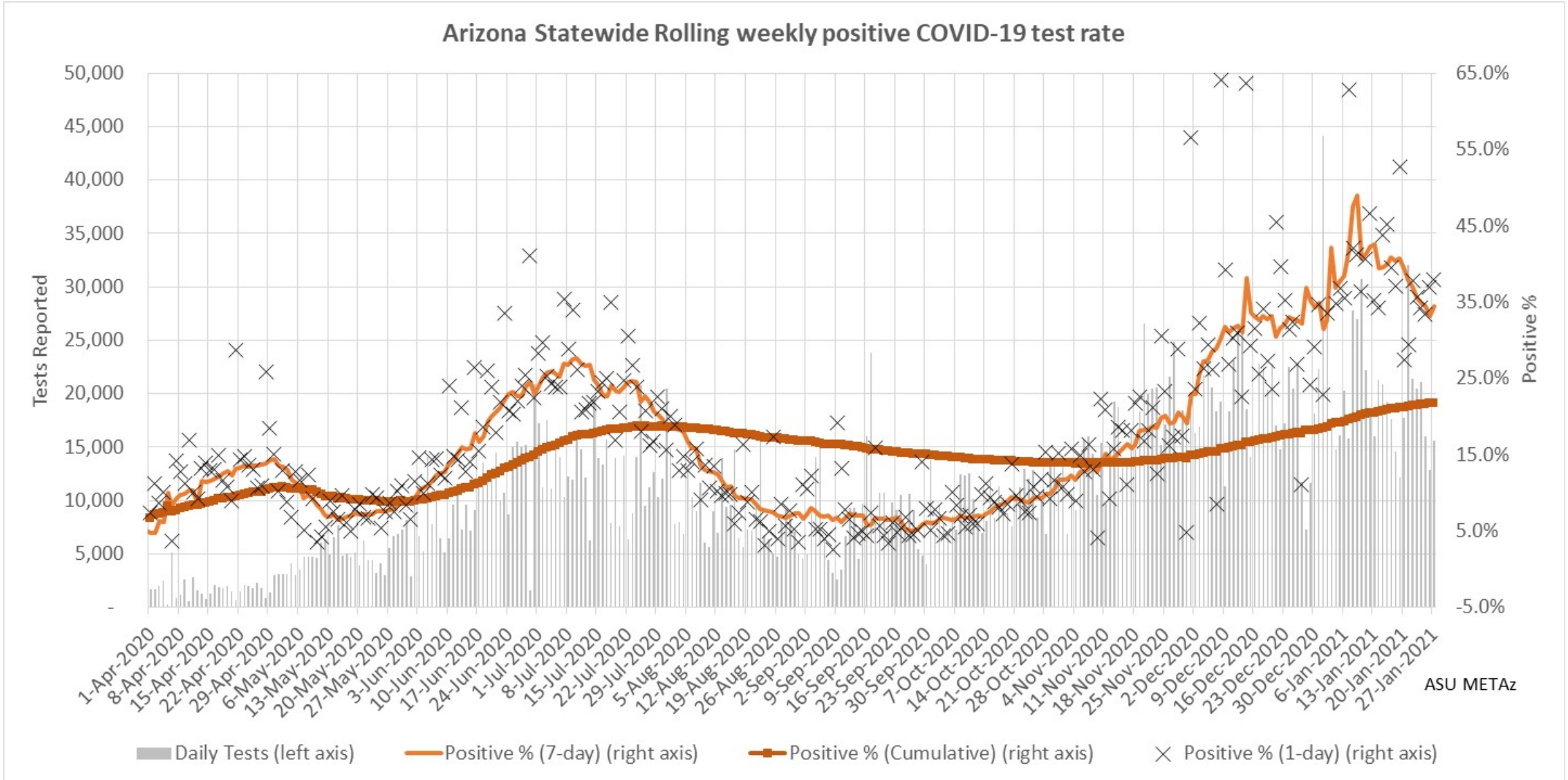
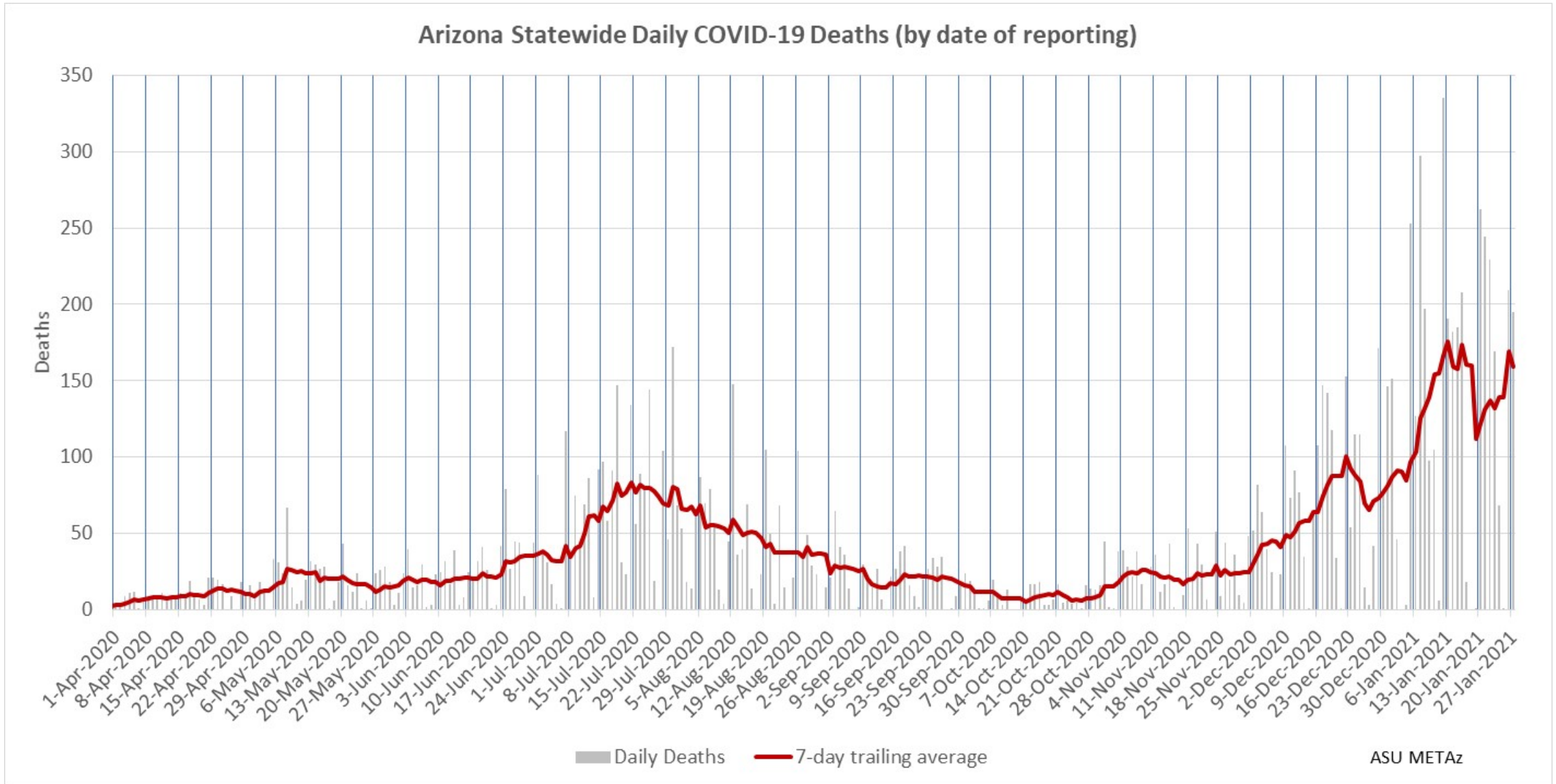
These projections are not intended to be predictions or quantitative guesses about what will actually happen in the mid-range (weeks-to-months) or long-term (months-to-years). They are intended to show current trends projected into the future and the relative effects of changes in transmission, social 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.

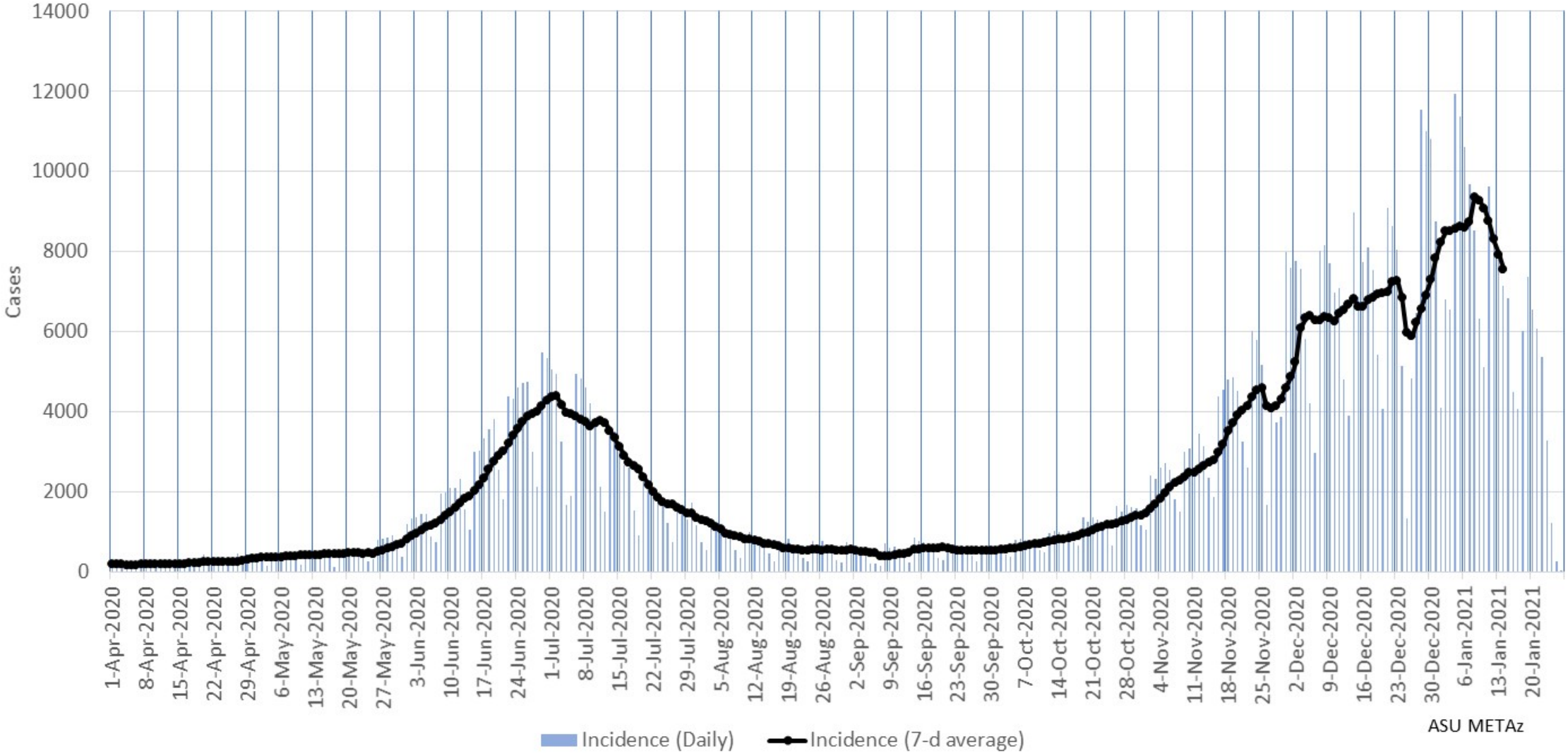
Epidemiology

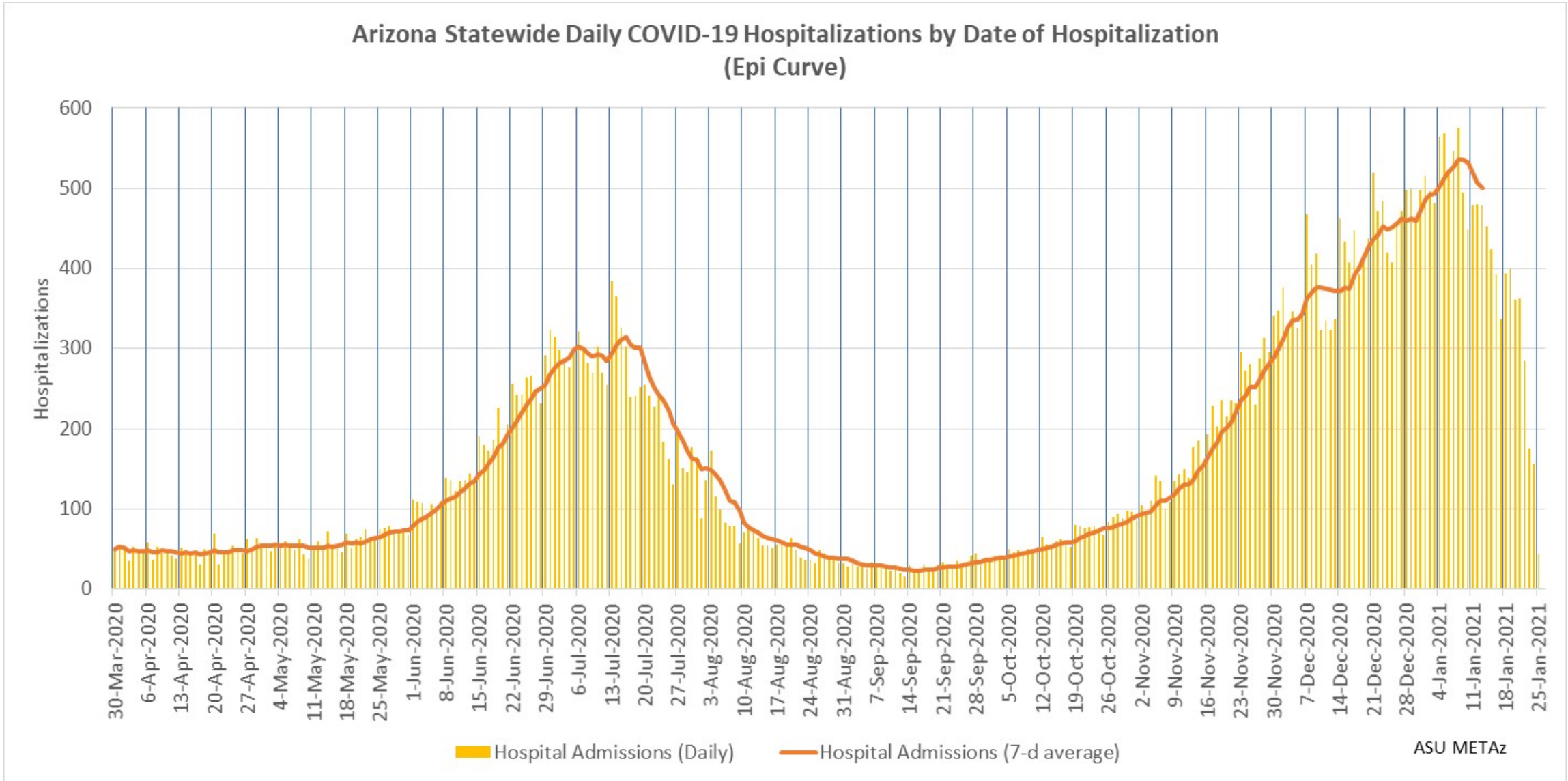


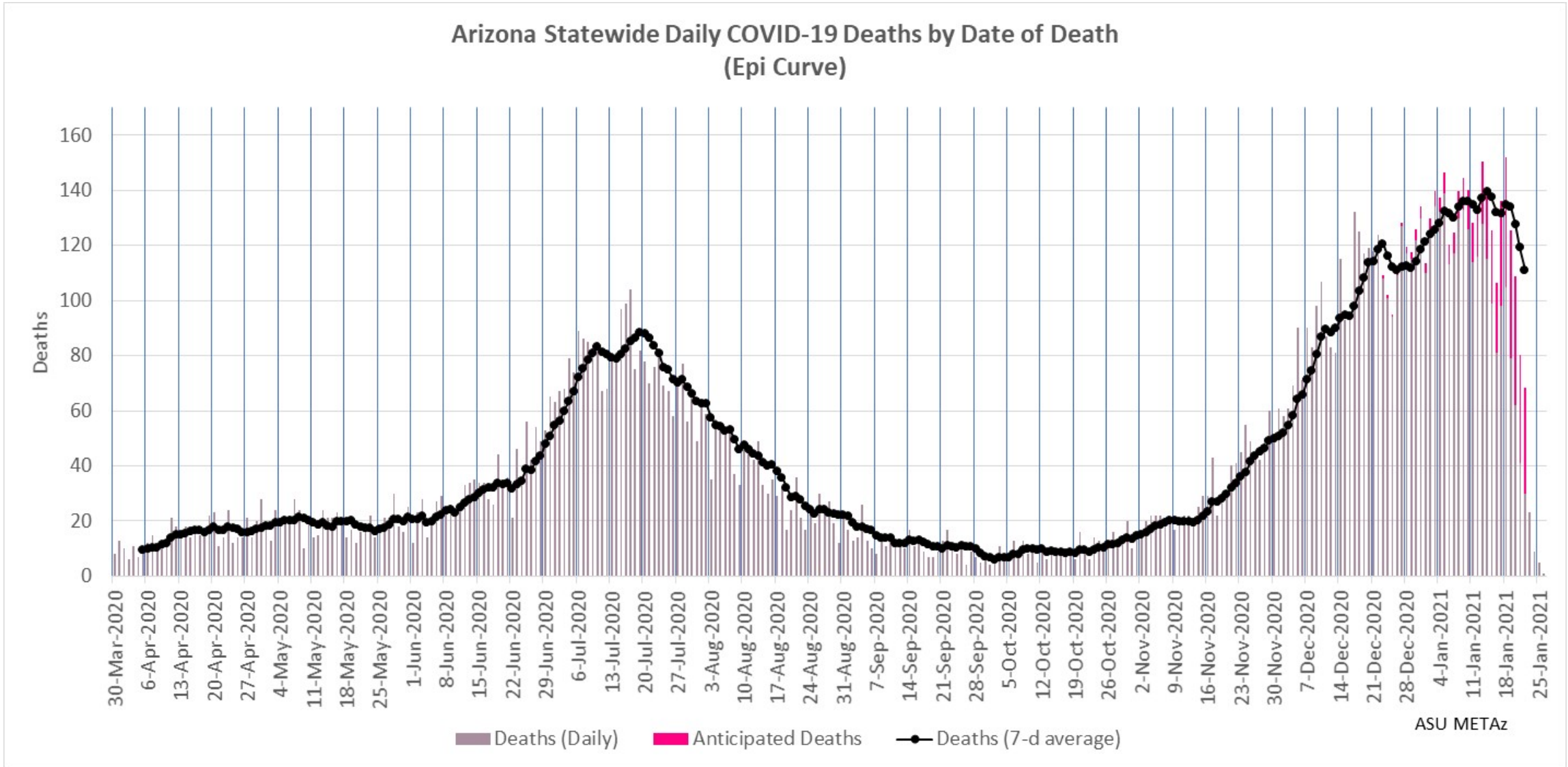




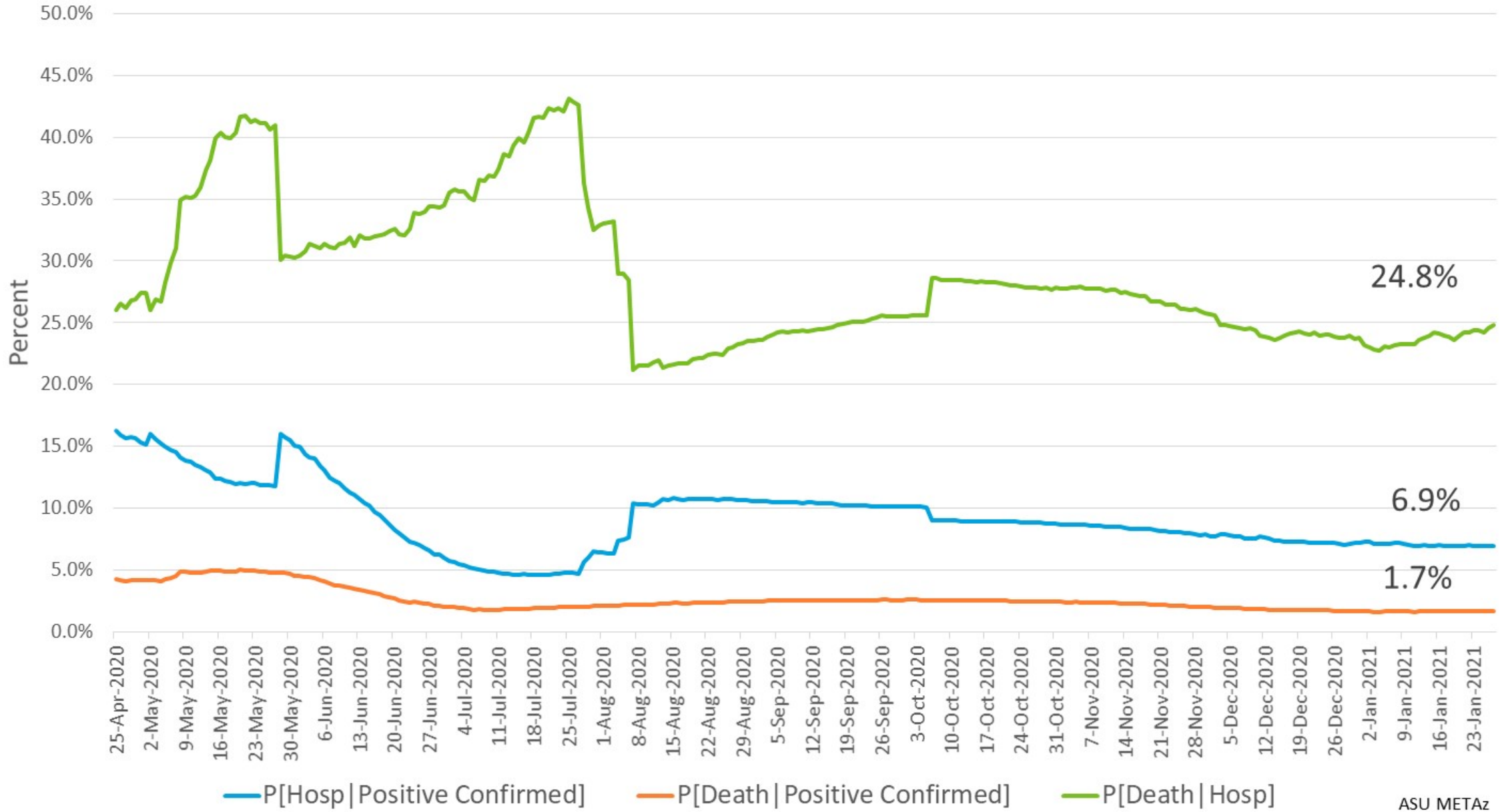
Arizona Statewide Daily COVID-19 Cases by Date of Sample Collection (Epi Curve)



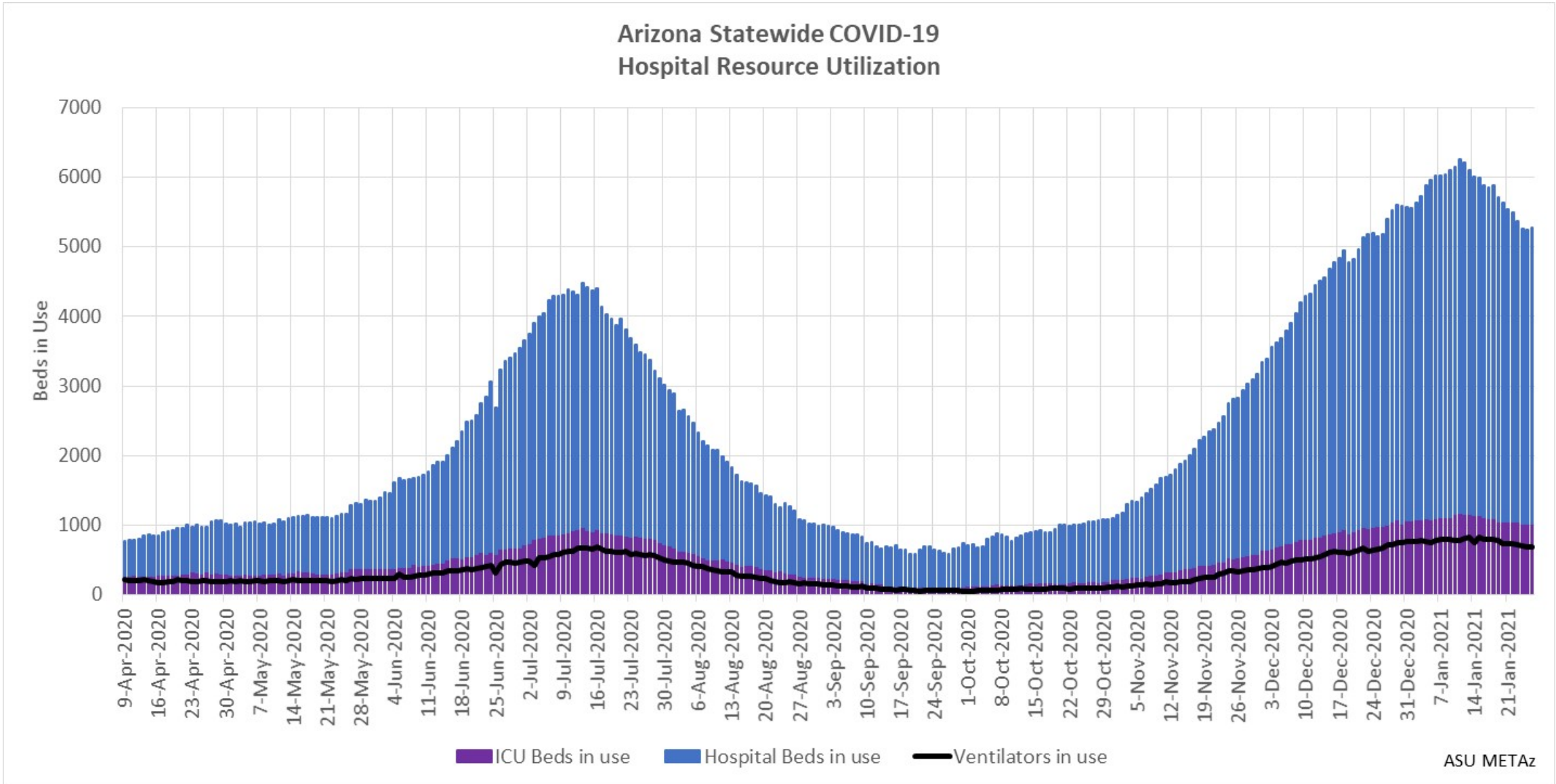


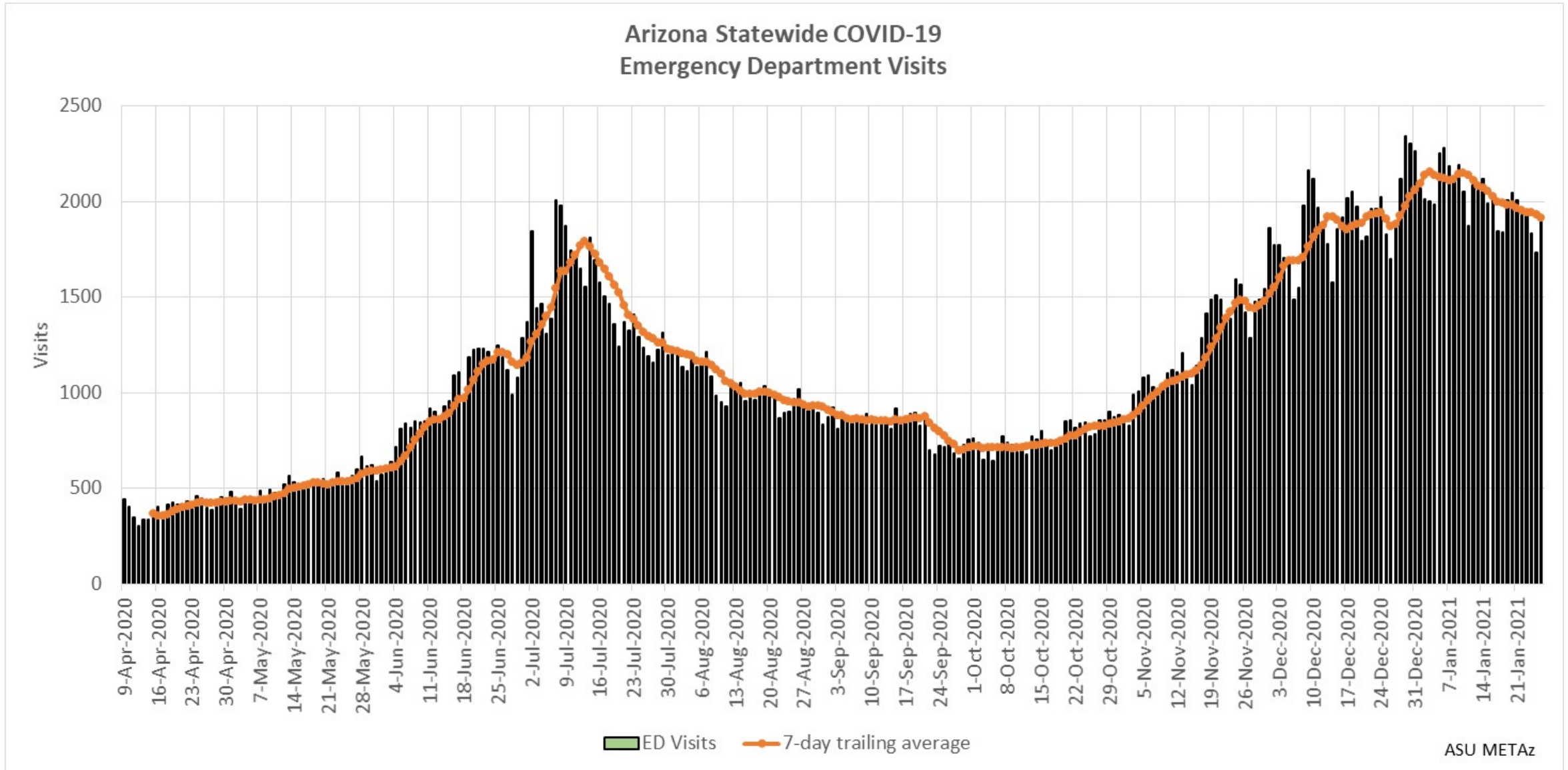


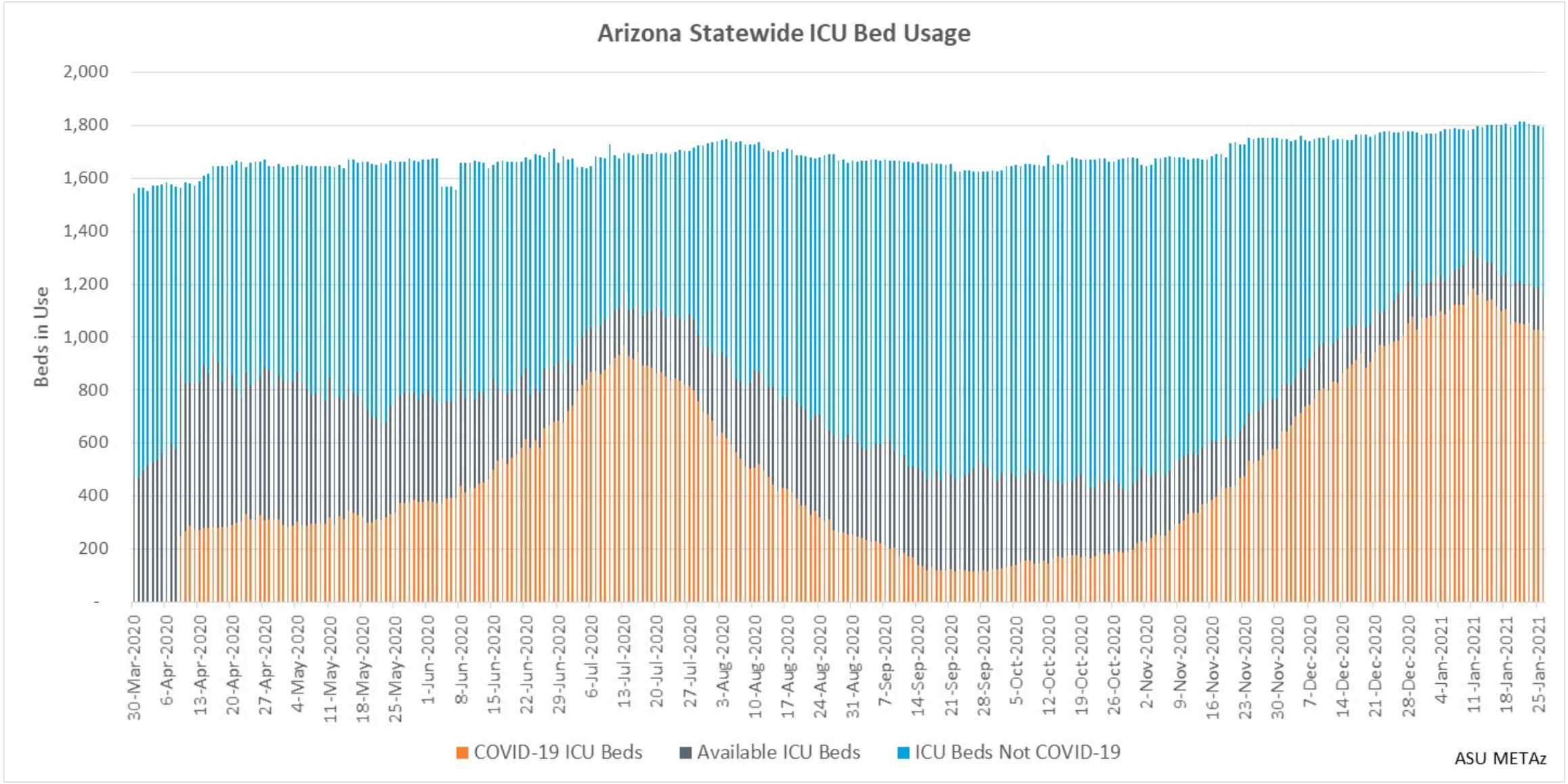
Arizona Statewide Case Fatality and Hospitalization Rates

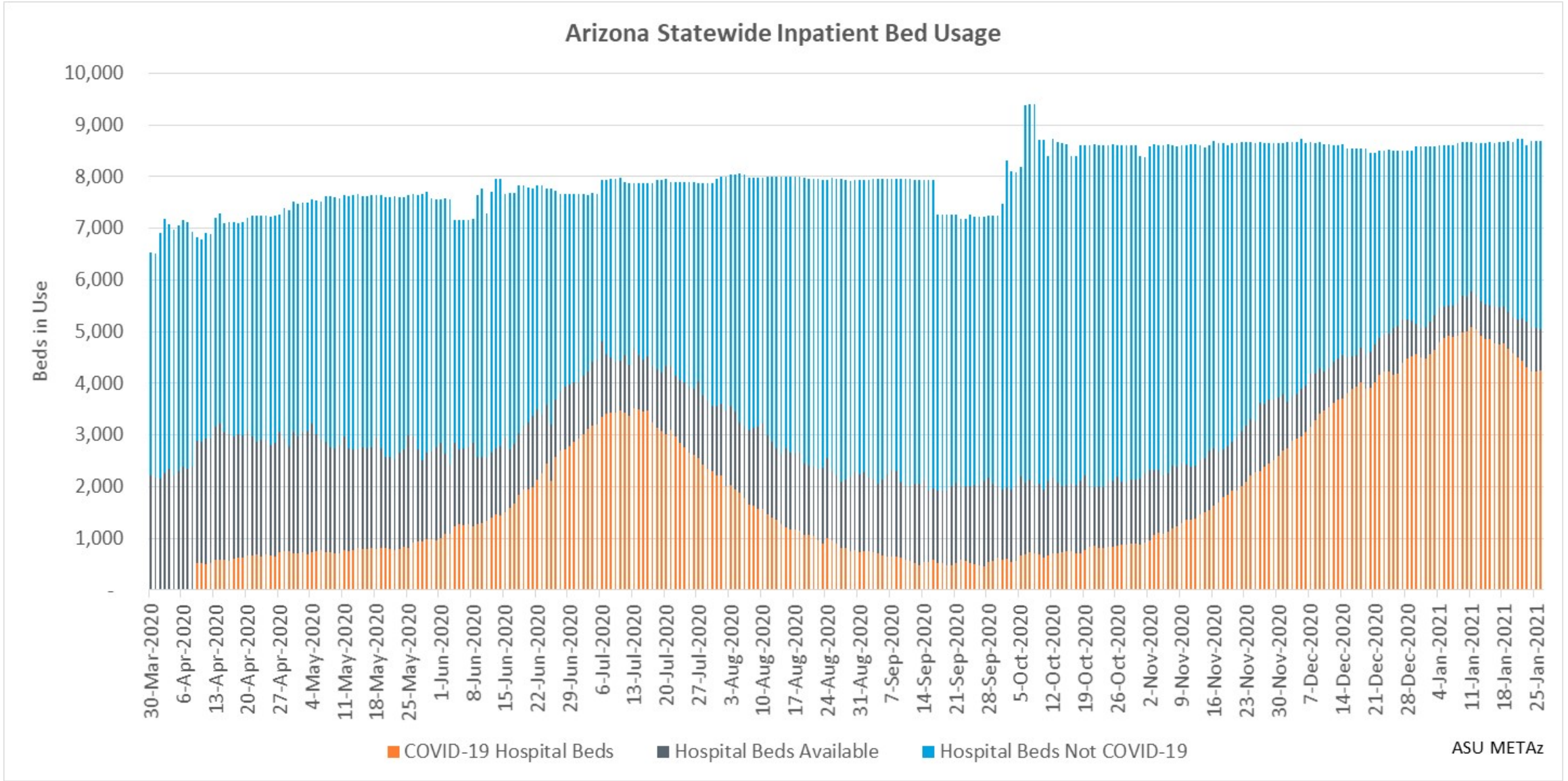


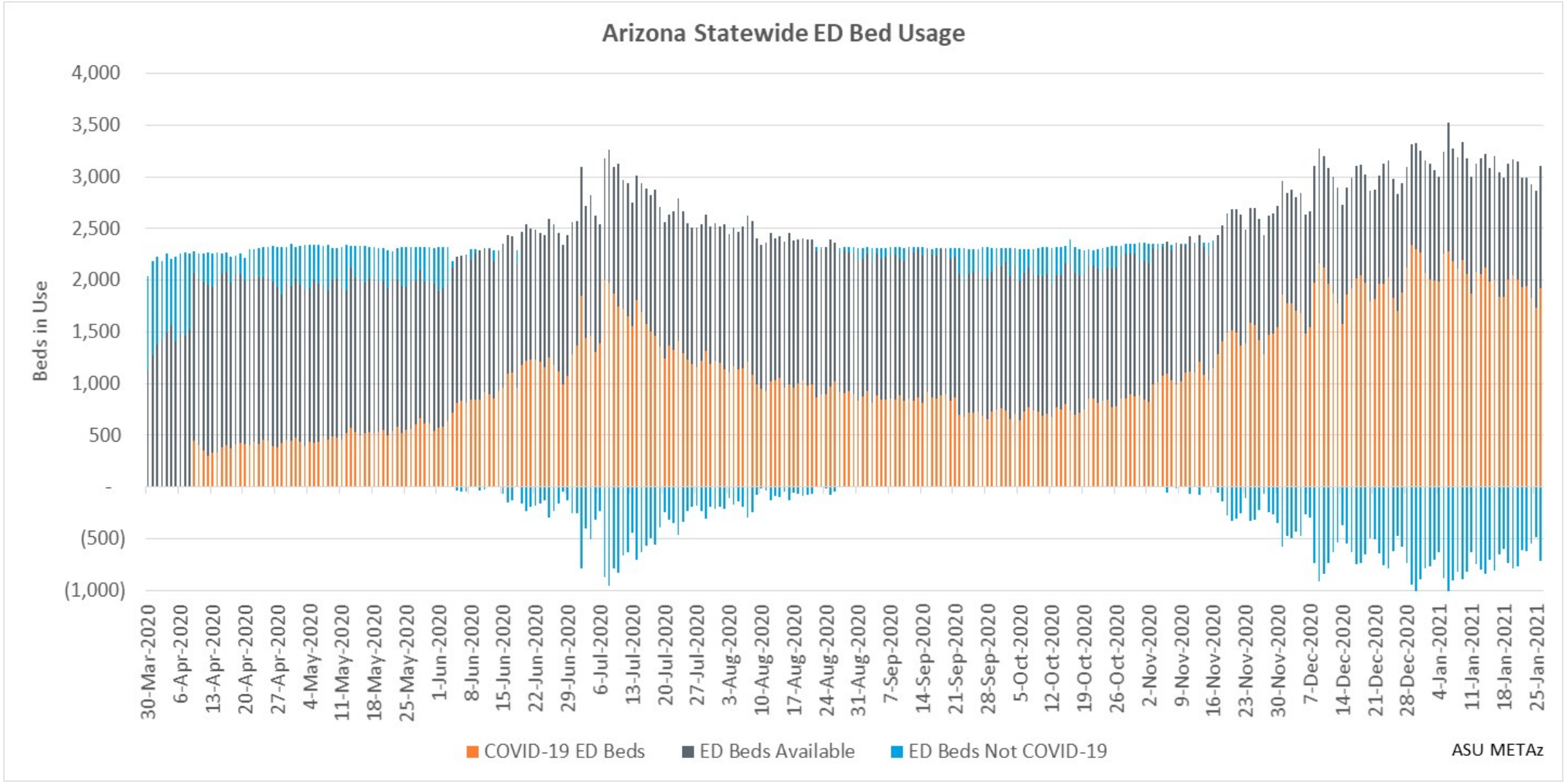
Hospital Usage







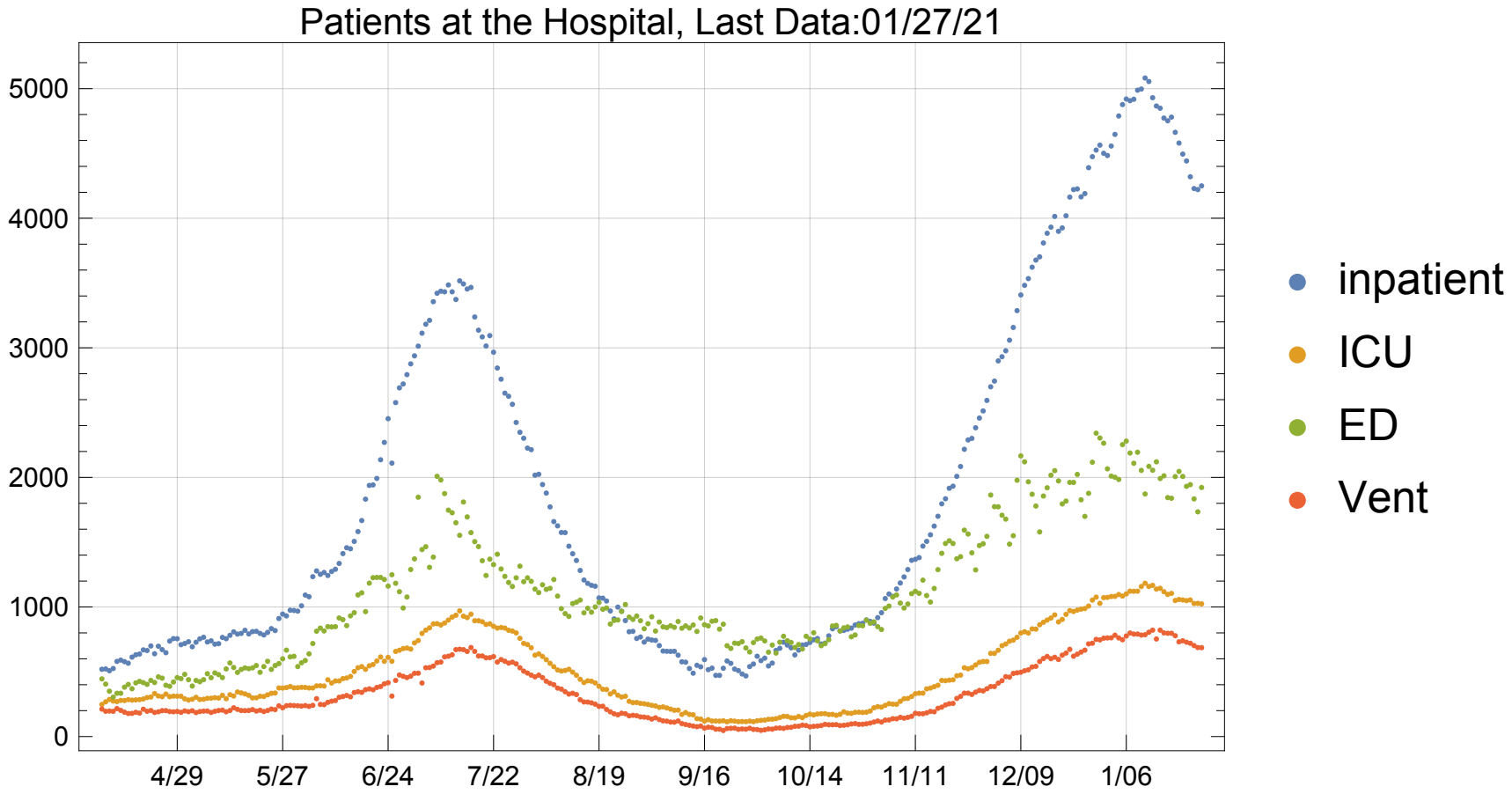




Where blue bars are below zero, COVID ED patients exceeded total reported ED bed usage

Data

Hospitalizations



Pre-publication. Results subject to peer-review.

Projections

Assumptions

- Changes in transmission rate are estimated from data at discrete time-intervals to fit epidemiology and hospitalization data.
- High variance in the data in December and January indicates capacity constraints and under-reporting of data:
  - Hospital occupancy data is auto-correlated with available beds indicating that severe cases are not receiving adequate care in a hospital setting from the third week of December through the second week of January.
  - Excessively elevated %-positive test rates indicate under-testing and resulting under-detection of cases likely due to testing fatigue and diminution of public health messaging efficacy.
  - Despite capacity within state-wide testing, equitable access to testing appears to omit vulnerable and at-risk demographic and occupational groups who remain silent in the data.
  - Data lags during holidays (pauses in reporting) increase uncertainty of forward-looking projections.
- Early scientific results on emerging variants indicate that evolutionary fitness of novel strains will correspond to heightened transmission and mortality.

Pre-publication. Results subject to peer-review.

Scenarios

- The following estimates were generated on 1/27/2021 with data through 1/26/2021.
- We have narrowed our scenario bands from +/- 15% to +/- 10% change in transmission rate.
- All scenarios implicitly assume that with the recent decline in hospitalizations that severe case counts are back in alignment with hospitalization data, which may be an under-estimate of the burden of disease.
- Updated transmission rate of beta = 0.17 from 12/27 – 1/25.

Pre-publication. Results subject to peer-review.

Scenario Beta Changes

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 → 47% decrease
- Efforts to fit data to hospitalizations, ICU and deaths tend to indicate transmission rate increase around 9/7 → 79% increase
- Another increase in transmission rate observed around 10/26 → 14% increase
- We observe a slight decrease in transmission rate after Thanksgiving, around 11/29 → 10% decrease
- Finally, a subsequent decrease in transmission rate observed around 12/27 → 23% decrease

Scenario +10% - High

0.225	05/15 – 07/02
0.120	07/03 – 09/07
0.215	09/08 – 10/25
0.245	10/26 – 11/28
0.220	11/29 – 12/26
0.170	12/27 – 01/25
0.187	01/26 – 03/10

Scenario Current Fit

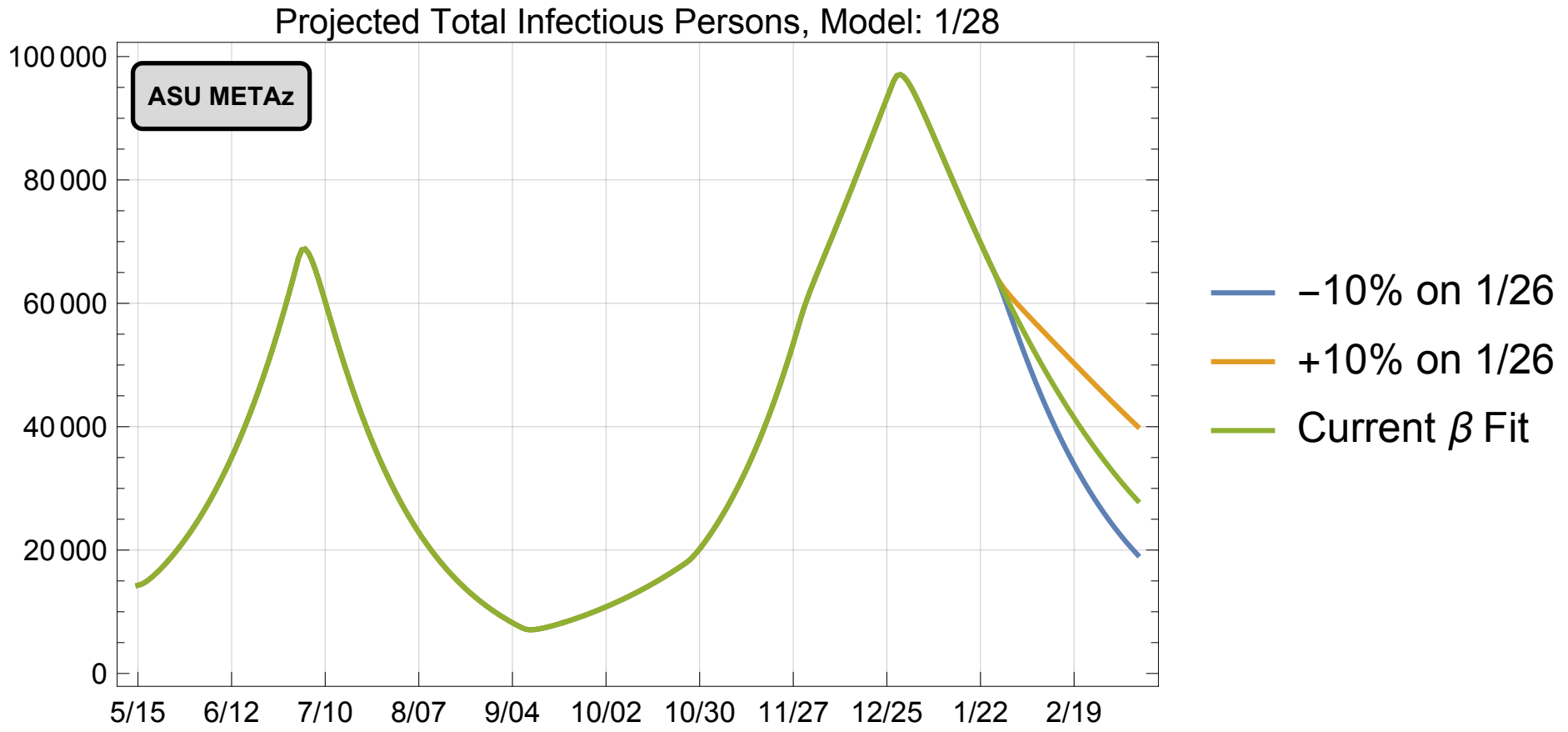
0.225	05/15 – 07/02
0.120	07/03 – 09/07
0.215	09/08 – 10/25
0.245	10/26 – 11/28
0.220	11/29 – 12/26
0.170	12/27 – 01/25
0.170	01/26 – 03/10

Scenario -10% - Low

0.225	05/15 – 07/02
0.120	07/03 – 09/07
0.215	09/08 – 10/25
0.245	10/26 – 11/28
0.220	11/29 – 12/26
0.170	12/27 – 01/25
0.187	01/26 – 03/10

Pre-publication. Results subject to peer-review.

Projections for Total Infectious



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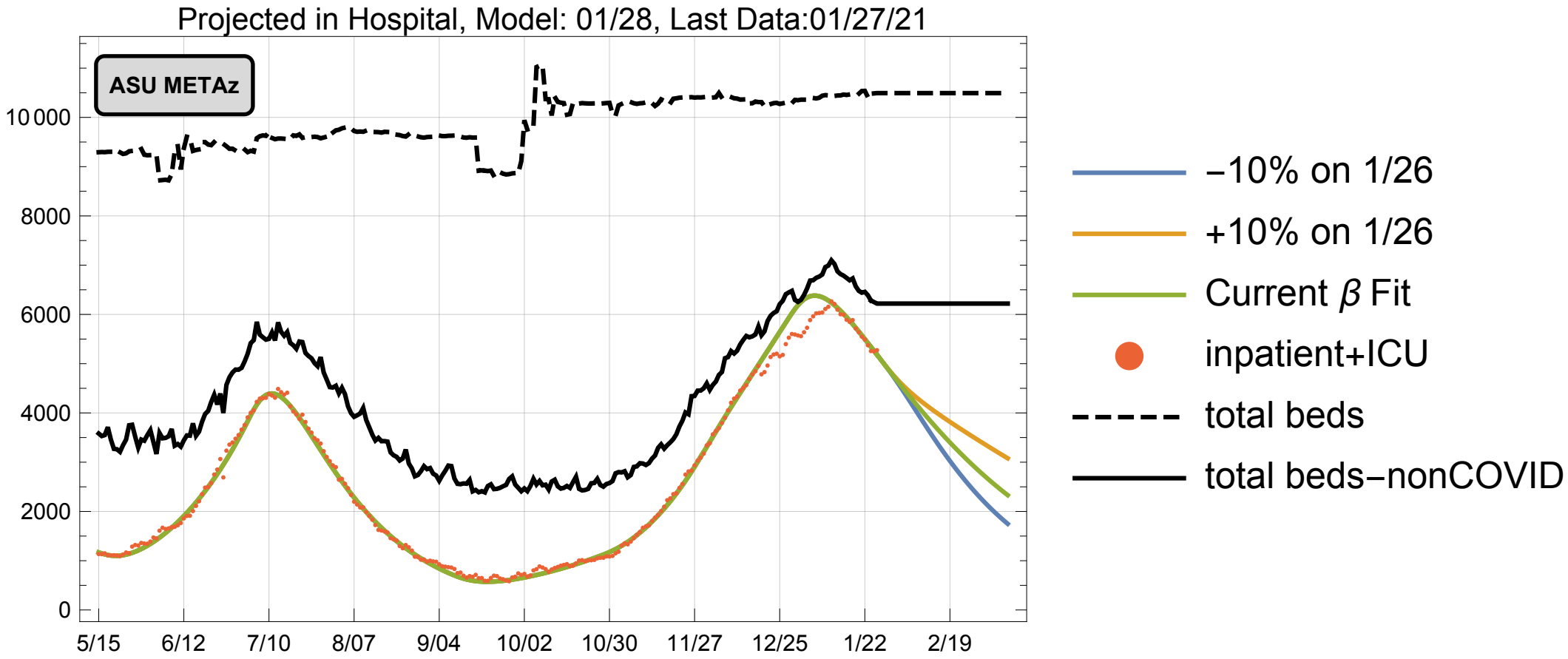
Hospitalization Projections



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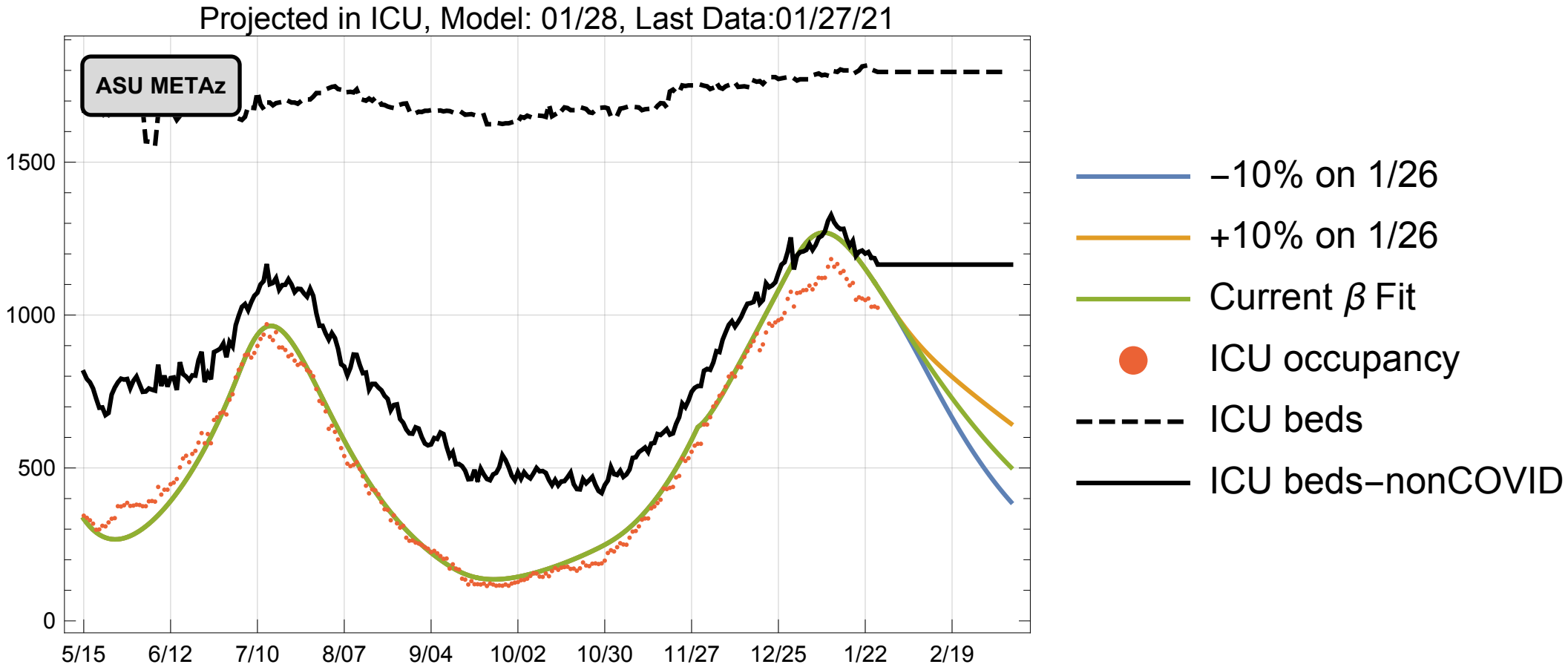
Projections for ICU Usage



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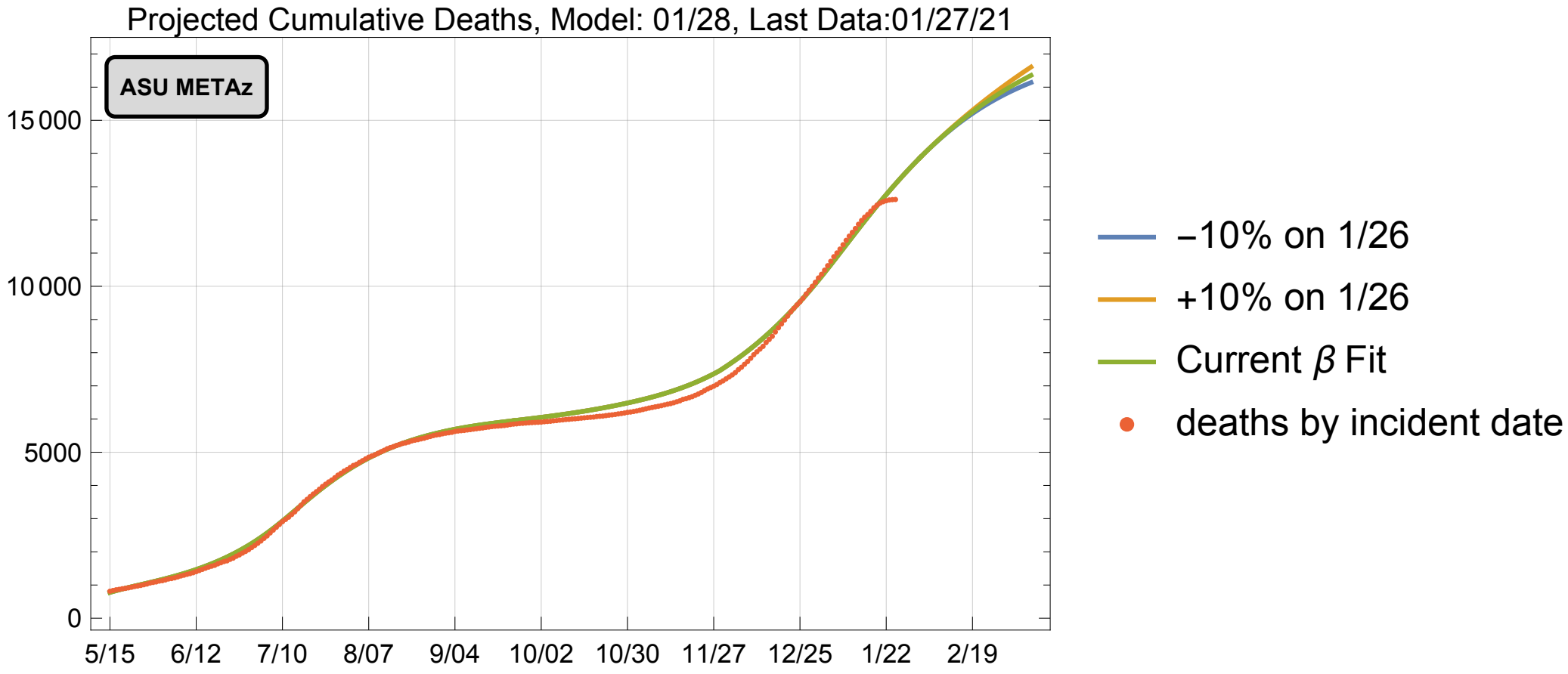
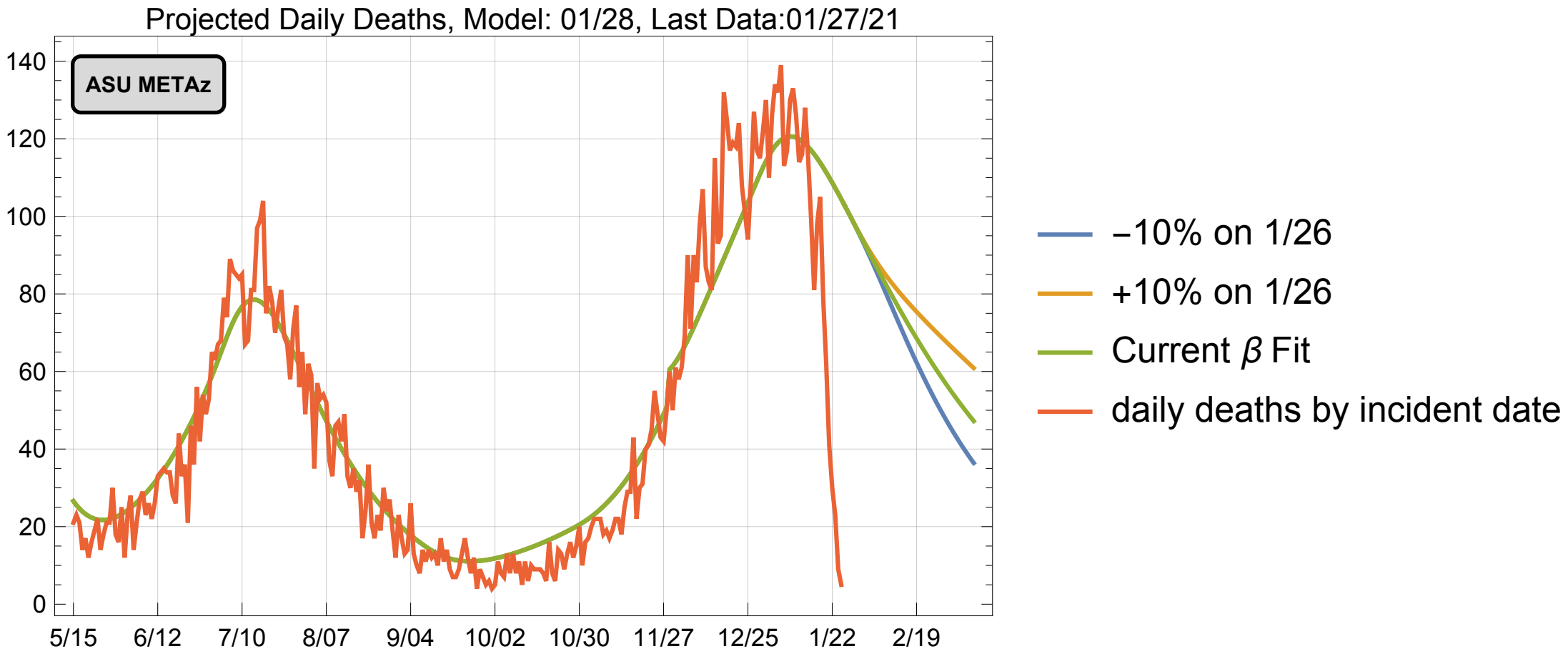
Projections for Cumulative Deaths



Pre-publication. Results subject to peer-review.

Projections for Daily Deaths



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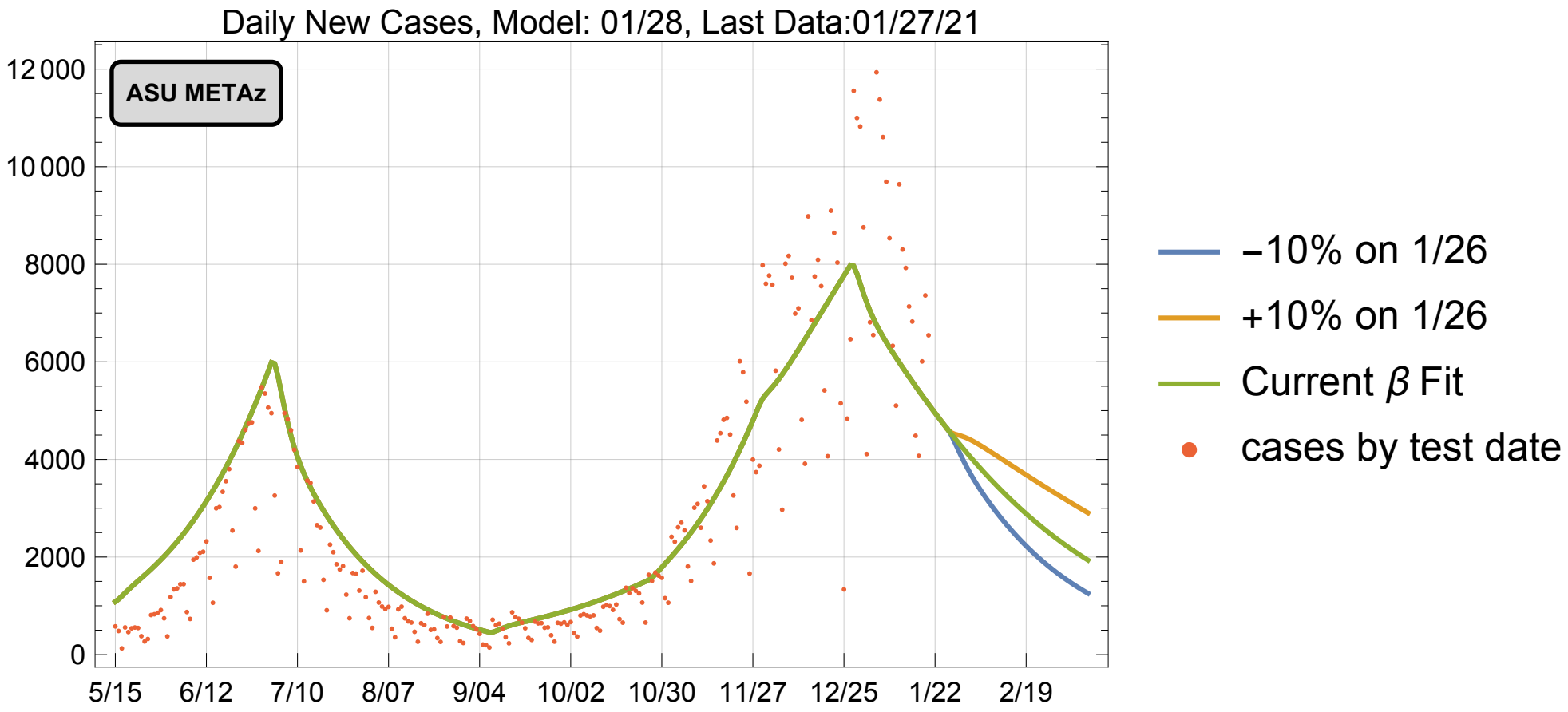
Daily Cases by Test Date



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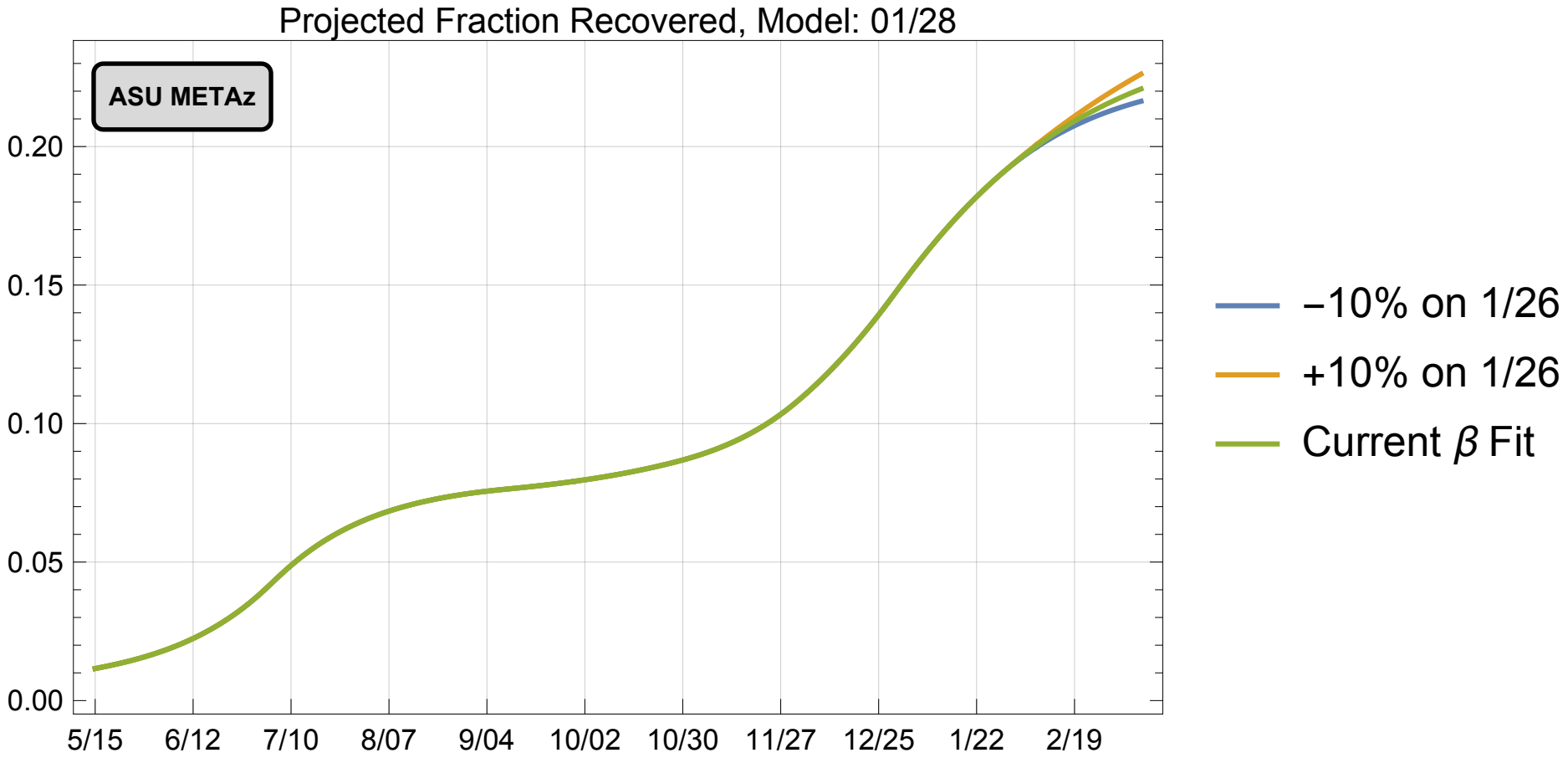
Projections for Total Recovered



Pre-publication. Results subject to peer-review.

Conclusions

- The decreasing trends in hospitalization, ICU, and mortality appear robust enough to conclude that transmission has declined to a reduced and stable level that will decompress the hospitals over time.
- Vaccination acquired immunity currently accounts for ~1.1% of the AZ population – not enough to materially change transmission dynamics yet.
- There is now a window of opportunity to establish a pandemic management paradigm that can avoid future over-runs of the hospital system rather than laissez-faire health policy.
- Dynamics can be best explained by observing that a large proportion of the population has adopted austere stay-at-home behaviors but would like to return to normal activities when possible.
- In contrast, many individuals and communities cannot consistently avoid risk, resulting in still-unaddressed inequities that are consistent with demographic data.

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Questions