## Parameter estimates and model fit – 6/30/2020

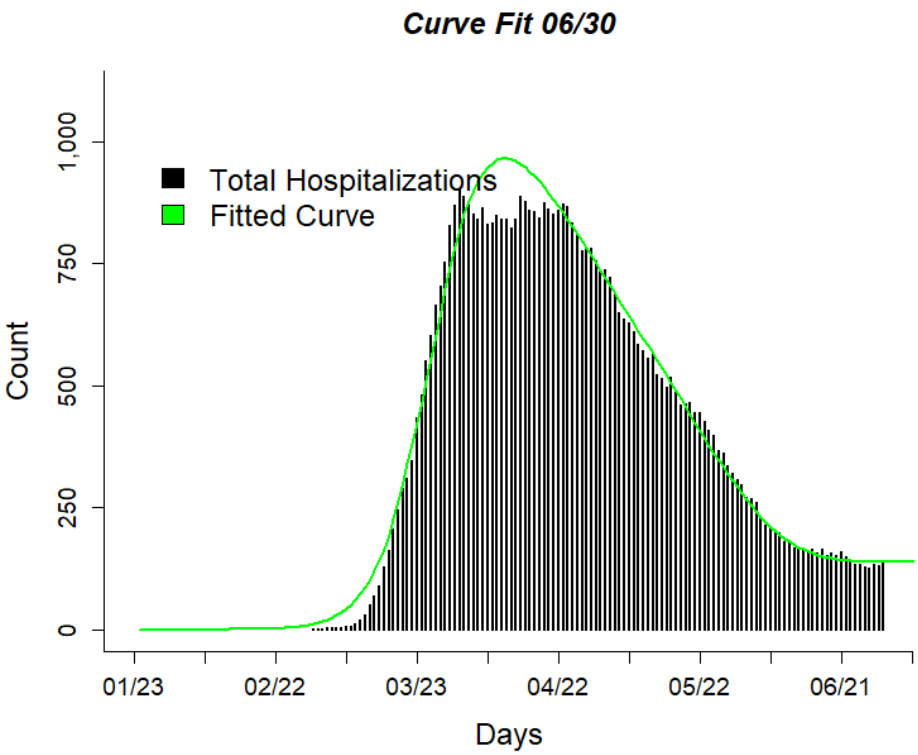


**Figure 1.** Current model fit (green line) to count of hospitalized COVID-19 cases (black lines) using the age-structured SEIR model. Hospitalized COVID-19 cases are from CDPHE reported COVID-19 hospitalizations and EMResource (EMR) hospital census data provided by CDPHE.

## Estimated effective reproductive number

**Table 2.** Current estimates of the effective reproductive number in Colorado

| | **Estimate** | **Notes** |
|---|---|---|
| Our current estimate of Re, approach 1* | 1.08 | Fit to data through 6/30/2020 |
| Current estimate of Re, approach 2* | 1.33 | Fit to data through 6/30/2020 |
| Estimate from RT-Live | 1.00 | As of 6/30/2020 |
| https://covid19.uclaml.org/ | 0.72 | As of 6/30/2020 |
| https://covid19-projections.com/us-co | 1.06 | As of 6/30/2020 |

*Because of the 13-day lag between infection and hospitalization, on average, our current estimate reflects transmission on approximately June 17. Approach 1 uses model output to estimate the average number of new cases generated by cases, accounting for the latent period and duration of infectiousness. The second method uses the model structure to estimate the dominant eigenvalue for a matrix of describing population across the model compartments.

**Table 2.** Estimated model parameters based on fitting our model output of total hospitalizations to reported hospitalizations in Colorado.

| | Range of possible values | Fitted value | Fit using data through |
|---|---|---|---|
| **Social distancing*** | | | |
| Phase 1. Estimated social distancing from mid-March until the start of the stay at home order, modeled as 3/17 - 3/25 | 10 – 70% | 50% | 06/24 |
| Phase 2. Estimated social distancing during the state-wide stay at home order, modeled as 3/26 to 4/26 | 50 – 99% | 79% | 06/24 |
| Phase 3. Estimated social distancing during the transition to state-wide Safer at Home, modeled as 4/27 to 05/08† | 50 – 99% | 80% | 06/24 |
| Phase 4. Estimated social distancing during early state-wide Safer at Home, modeled as 05/09 to 05/26† | 50-99% | 89% | 06/30 |
| Phase 5. Estimated social distancing during Safer at Home as more businesses re-open, 5/27-present† | 50-99% | 68% | 06/30 |
| **Mask wearing** | | | |
| Percent of individuals wearing masks, 4/4 to 4/27 | | 50% | Assumed¶ |
| Percent of individuals wearing masks, 4/27 to present | | 70% | Assumed¶ |
| **Case isolation** | | | |
| Decrease in infectious - symptomatic contact rate due to self-isolation by symptomatic after March 5 (dividing by 0.57 gives proportion that self-isolate) ** | 0.1 - 0.8†† | 0.44 | 06/24 |
| **Case detection** | | | |
| Proportion of cases detected over the last 14 days | | | |
| **Transmission parameters** | | | |
| The rate of infection (beta) | 0.2 - 0.6†† | 0.48 | 06/24 |
| Ratio of infectiousness for symptomatic vs. asymptomatic individuals (lambda) | 1.0 - 4.0†† | 1.39 | 06/24 |

*The social distancing parameter estimates the percent decrease in effective contacts between susceptible and infectious individuals. This parameter accounts for social distancing policies intended to avoid contact altogether (e.g., through workplace and school closures) as well as policies and individual behaviors to reduce potential contact with the virus (e.g., maintaining at least 6 feet of distance between people outside of one's household, and handwashing).

†Social distancing estimated weekly and averaged over time period of interest.

¶Given the difficulty in disentangling the effect of mask wearing from social distancing in decreasing transmission, we cannot fit this parameter at this time. Survey data suggests current levels of mask wearing are approximately 70%.

**Self-isolation by symptomatic cases is assumed to occur 1 day after the onset of infectiousness and decrease the 67% of contacts that typically occur outside of the home. This parameter jointly accounts for the percent of symptomatic individuals that self-isolate and the imperfect decline in contacts. Dividing the value in the table by 0.57 gives the proportion of symptomatic individuals that self-isolate.

††The range of potential parameter values for case isolation [1] and the rate of infectiousness for symptomatic vs. asymptomatic individuals [2, 3] are based on the literature, and for the rate of infection, were obtained from the MIDAS Online COVID-19 compilation of parameter estimates here.

## References


1. Ferguson, N., et al., *Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand*. 2020. Available: https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf.
2. Li, R., et al., *Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV-2).* Science, 2020. **368**(6490): p. 489-493.
3. Zou, L., et al., *SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients.* N Engl J Med, 2020. **382**(12): p. 1177-1179.