COVID-19 Modeling Update
April 20, 2020
Agenda

- Dr. Rachel Herlihy, state epidemiologist, CDPHE
- Dr. Jonathan Samet, Dean, Colorado School of Public Health
- Questions and answers

Moderator: Ali Cox
Case Data

10,098 ............ Reported cases
1,859 .............. Hospitalized
56 .................. Counties
47,466 ............. People tested
111 .................. Outbreaks
444 .................. Deaths

Updated April 20, 2020  12 pm
COVID-19

Estimate:
65,000 – 75,000
Coloradans have had COVID-19

(1.1% – 1.3% of Colorado’s population)
Modeling Questions

• When will infections peak?
• How soon will we reach hospital and ICU bed capacity?
• How many hospital and ICU beds will be needed?
• What will the impact of social distancing be? What has been the effect to date?
• What will happen if social distancing is relaxed?
• What other strategies may be effective at controlling transmission of COVID-19?
Modeling Questions

- When will infections peak?
- How soon will we reach hospital and ICU bed capacity?
- How many hospital and ICU beds will be needed?
- What will the impact of social distancing be?
- What has been the effect to date?
- What will happen if social distancing is relaxed?
- What other strategies may be effective at controlling transmission of COVID-19?
Goal

- Find sustainable interventions that suppress disease transmission with minimal economic impact
- The menu of options:
  - Social distancing
  - Rapid case identification, testing
  - Isolation, contact tracing, quarantine
  - Community use of masks
- What combination and how do they add up to be enough?
- Simultaneously increasing health care capacity
Role of Models in COVID-19 Pandemic

• Infectious disease models long used to project the course of epidemics and to plan how to end them.
• Mathematical representations of how infections spread within populations.
• Many approaches to modeling and many different modelers.
• But, a fundamental tool for planning strategies for the COVID-19 epidemic.
The Colorado Model

Key assumptions
- Once a person is infected, their probability of developing symptoms and the severity of symptoms is age-dependent
- An individual acquires at least short-term immunity following infection
- The reported cases in Colorado do not represent all COVID-19 cases in Colorado
- Individuals needing ICU care in excess of capacity die
- No further transmission occurs once a patient enters a hospital
Onset of Illness for 1st Case: 02/20

Phase 1 Social Distancing Begins: 03/26

Phase 2 Social Distancing Begins: 03/17

Today: April 27
The Impact of the March 17 and March 26 Measures
Reported CO cases of COVID-19, by symptom onset date, and estimated number of reported cases under social distancing that reduced the contact rate by 75% (red line), 76.5% (green line) and 78% (blue line).

Fitted Curve - Detected Cases

Bending the curve
Projections for Scenarios from April 27 Forward
Moving Forward

• Goals:
  • Assure that health care capacity not exceeded
  • Vulnerable populations protected
  • While maintaining sustainable social distancing measures

• Tools
  • Ongoing, sustainable social distancing
  • Testing
  • Case identification and isolation
  • Contact tracing
  • Masks
Scenarios Moving Forward

• **Scenario A.** Maintaining a sustainable level of social distancing by the general public.

• **Scenario B.** Maintaining a sustainable level of social distancing by the general public plus advise older adults (age>60) to maintain high levels of social distancing.

• **Scenario C.** Maintaining a sustainable level of social distancing and promote mask wearing by the public

• **Scenario D.** Maintaining a sustainable level of social distancing and pursue aggressive case detection and containment.

• **Scenario E.** Maintaining a sustainable level of social distancing, promote mask wearing and pursue aggressive case detection/containment (scenarios A + C + D)

• **Scenario F.** Maintaining a sustainable level of social distancing, promote mask wearing, pursue aggressive case detection/containment and recommend older adults maintain high levels of social distancing (scenarios A + B + C + D)
Scenario A: Projected hospitalizations and ICU need under relaxed social distancing scenarios implemented on 4/27/20 without complementary interventions
Projected timing and magnitude of the peak number of infections and peak number of hospitalizations for an array of social distancing scenarios implemented on 4/27 and maintained indefinitely.

<table>
<thead>
<tr>
<th>Scenario A – relax to 35% SD</th>
<th>Num*</th>
<th>Date</th>
<th>Num*</th>
<th>Date</th>
<th>Num*</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>151,000</td>
<td>07/10/2020</td>
<td>51,000</td>
<td>07/17/2020</td>
<td>20,200</td>
<td>07/21/2020</td>
</tr>
<tr>
<td>Scenario A – relax to 45% SD</td>
<td>111,000</td>
<td>07/26/2020</td>
<td>38,400</td>
<td>08/02/2020</td>
<td>15,600</td>
<td>08/07/2020</td>
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<tr>
<td>Scenario A – relax to 55% SD</td>
<td>65,600</td>
<td>08/24/2020</td>
<td>23,200</td>
<td>08/31/2020</td>
<td>9,670</td>
<td>09/06/2020</td>
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<td>Scenario A – relax to 60% SD</td>
<td>41,800</td>
<td>09/18/2020</td>
<td>14,900</td>
<td>09/26/2020</td>
<td>6,330</td>
<td>10/02/2020</td>
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<tr>
<td>Scenario A – relax to 65% SD</td>
<td>19,800</td>
<td>10/30/2020</td>
<td>7,140</td>
<td>11/07/2020</td>
<td>3,070</td>
<td>11/13/2020</td>
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</tbody>
</table>
Conclusion: Social distancing alone (Scenario A) is not sufficient moving forward
Scenario B

Greater Distancing for Older Adults
Scenario C

Total Hospitalizations, Scenario C

- 45% SD
- 55% SD
- 65% SD

ICU Need, Scenario C

- 45% SD
- 55% SD
- 65% SD

Mask Wearing
Scenario D

Total Hospitalizations, Scenario D

ICU Need, Scenario D

Case Detection and Isolation
Scenario E

Total Hospitalizations, Scenario E

ICU Need, Scenario E

Masks and Case Detection and Isolation
Scenario F

**Total Hospitalizations, Scenario F**

- 45% SD
- 55% SD
- 65% SD

**ICU Need, Scenario F**

- 45% SD
- 55% SD
- 65% SD

**All Interventions**
Projected timing and magnitude of the peak number of ICU hospitalizations for interventions (Scenarios A-F)

<table>
<thead>
<tr>
<th>Complementary interventions</th>
<th>Relax social distancing to 45%</th>
<th>Relax social distancing to 55%</th>
<th>Relax social distancing to 65%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Est. peak ICU need*</td>
<td>Est. date of ICU peak</td>
<td>Est. peak ICU need*</td>
</tr>
<tr>
<td>Scenario A: Partial relaxation of social distancing (reference)</td>
<td>15,600</td>
<td>08/07/2020</td>
<td>9,670</td>
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<tr>
<td>Complementary interventions</td>
<td>Scenario B: Older adults maintain social distancing at current high levels</td>
<td>7,530</td>
<td>8/28/2020</td>
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<td></td>
<td>Scenario C: Mask wearing by the public</td>
<td>12,600</td>
<td>08/20/2020</td>
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<tr>
<td></td>
<td>Scenario D: Improved case detection and isolation</td>
<td>14,700</td>
<td>08/07/2020</td>
</tr>
<tr>
<td>Combinations of complementary interventions</td>
<td>Scenario E: Mask wearing, and improved case detection and containment</td>
<td>11,200</td>
<td>08/20/2020</td>
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<tr>
<td></td>
<td>Scenario F: Mask wearing, improved case detection and containment, and older adults maintain current high levels of social distancing</td>
<td>4,100</td>
<td>09/10/2020</td>
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</table>
ICU need for phased reduction in social distancing in combination with all three complementary interventions. Projections for social distancing relaxed to 60% or 65% at the end of the stay-at-home order and then stepped down to 45% on June 1 or June 15.
Cautions

• These are estimates from models and subject to uncertainties
• We await more Colorado data on ICU use; critical care bed needs still uncertain
• And remember, consequences of changing policies are not seen for weeks or more
Bottom Line

• Need to use all modalities available
• Will need to closely track key indicators: case counts, ventilators used, deaths, and mobility
• Success involves individual responsibility
Q & A