IEM's AI Modeling: Short-term COVID-19 Projections

Date: 6/15/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 6/15/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

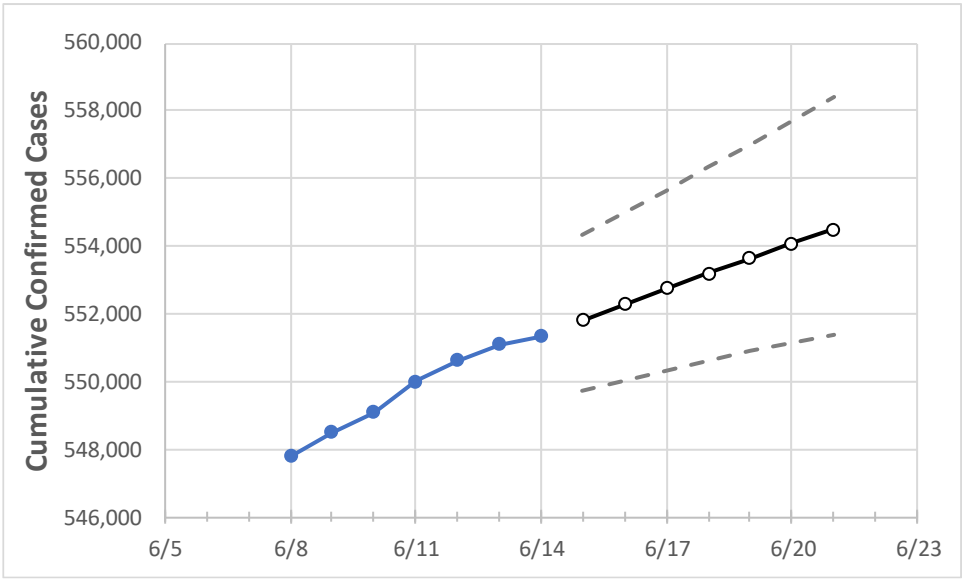
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Colorado State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21
Colorado	550,014	550,618	551,091	551,328	551,813	552,289	552,749	553,197	553,648	554,074	554,501

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Colorado Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21
Adams	60,279	60,332	60,369	60,397	60,431	60,461	60,492	60,522	60,551	60,580	60,608
Arapahoe	62,080	62,152	62,182	62,199	62,236	62,274	62,311	62,348	62,382	62,416	62,450
Boulder	23,842	23,850	23,855	23,861	23,872	23,884	23,894	23,905	23,915	23,925	23,936
Denver	73,764	73,831	73,876	73,893	73,946	73,998	74,050	74,101	74,153	74,205	74,255
Douglas	29,986	30,032	30,052	30,060	30,092	30,122	30,153	30,184	30,214	30,243	30,274
Eagle	6,337	6,340	6,341	6,341	6,343	6,344	6,346	6,347	6,349	6,351	6,352
El Paso	71,873	71,977	72,095	72,148	72,249	72,347	72,445	72,538	72,632	72,720	72,806
Gunnison	1,369	1,370	1,371	1,370	1,372	1,373	1,375	1,377	1,379	1,381	1,383
Jefferson	48,410	48,452	48,497	48,510	48,540	48,569	48,598	48,626	48,654	48,681	48,708
Larimer	27,295	27,326	27,338	27,356	27,378	27,399	27,419	27,440	27,461	27,481	27,502
Pueblo	19,341	19,369	19,406	19,409	19,430	19,451	19,471	19,491	19,511	19,531	19,551
Weld	33,010	33,043	33,063	33,084	33,114	33,142	33,169	33,196	33,224	33,250	33,276

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Colorado Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	6/11	6/12	6/13	6/14	6/16	6/18	6/20
Adams	60,279	60,332	60,369	60,397	60,461 (12,092) [2,902] {1,451}	60,522 (12,104) [2,905] {1,453}	60,580 (12,116) [2,908] {1,454}
Arapahoe	62,080	62,152	62,182	62,199	62,274 (12,455) [2,989] {1,495}	62,348 (12,470) [2,993] {1,496}	62,416 (12,483) [2,996] {1,498}
Boulder	23,842	23,850	23,855	23,861	23,884 (4,777) [1,146] {573}	23,905 (4,781) [1,147] {574}	23,925 (4,785) [1,148] {574}
Denver	73,764	73,831	73,876	73,893	73,998 (14,800) [3,552] {1,776}	74,101 (14,820) [3,557] {1,778}	74,205 (14,841) [3,562] {1,781}
Douglas	29,986	30,032	30,052	30,060	30,122 (6,024) [1,446] {723}	30,184 (6,037) [1,449] {724}	30,243 (6,049) [1,452] {726}
Eagle	6,337	6,340	6,341	6,341	6,344 (1,269) [305] {152}	6,347 (1,269) [305] {152}	6,351 (1,270) [305] {152}
El Paso	71,873	71,977	72,095	72,148	72,347 (14,469) [3,473] {1,736}	72,538 (14,508) [3,482] {1,741}	72,720 (14,544) [3,491] {1,745}
Gunnison	1,369	1,370	1,371	1,370	1,373 (275) [66] {33}	1,377 (275) [66] {33}	1,381 (276) [66] {33}
Jefferson	48,410	48,452	48,497	48,510	48,569 (9,714) [2,331] {1,166}	48,626 (9,725) [2,334] {1,167}	48,681 (9,736) [2,337] {1,168}
Larimer	27,295	27,326	27,338	27,356	27,399 (5,480) [1,315] {658}	27,440 (5,488) [1,317] {659}	27,481 (5,496) [1,319] {660}
Pueblo	19,341	19,369	19,406	19,409	19,451 (3,890) [934] {467}	19,491 (3,898) [936] {468}	19,531 (3,906) [938] {469}
Weld	33,010	33,043	33,063	33,084	33,142 (6,628) [1,591] {795}	33,196 (6,639) [1,593] {797}	33,250 (6,650) [1,596] {798}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.