

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

Date: 6/28/21

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 6/28/21 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.

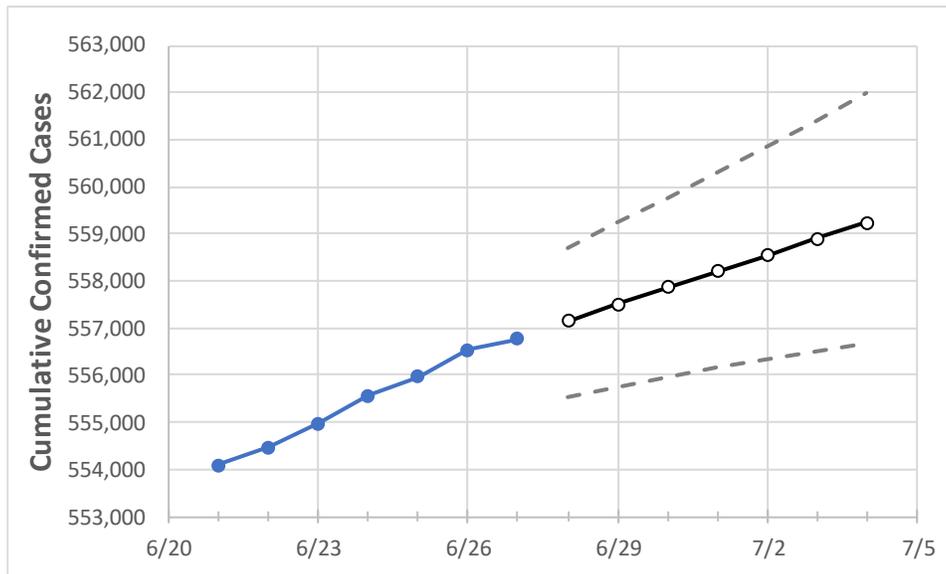
IEM's Modeling Lead

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:					
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	
Colorado	555,569	555,971	556,542	556,775	557,147	557,502	557,858	558,206	558,549	558,901	559,245	

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:					
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
Adams	60,733	60,768	60,806	60,821	60,848	60,874	60,899	60,923	60,946	60,970	60,993
Arapahoe	62,584	62,625	62,674	62,694	62,726	62,758	62,790	62,821	62,851	62,881	62,910
Boulder	23,931	23,940	23,953	23,961	23,969	23,978	23,986	23,994	24,002	24,010	24,018
Denver	74,188	74,219	74,257	74,288	74,309	74,329	74,349	74,368	74,387	74,406	74,424
Douglas	30,408	30,418	30,445	30,459	30,485	30,512	30,538	30,565	30,591	30,617	30,642
Eagle	6,347	6,350	6,352	6,352	6,354	6,356	6,358	6,360	6,361	6,363	6,365
El Paso	72,986	73,042	73,143	73,176	73,237	73,295	73,352	73,406	73,458	73,510	73,561
Gunnison	1,382	1,385	1,392	1,391	1,393	1,395	1,398	1,400	1,403	1,406	1,408
Jefferson	48,744	48,779	48,833	48,850	48,872	48,893	48,915	48,937	48,957	48,978	48,998
Larimer	27,599	27,618	27,638	27,646	27,665	27,684	27,703	27,721	27,740	27,757	27,775
Pueblo	19,537	19,559	19,569	19,571	19,582	19,593	19,604	19,614	19,625	19,634	19,644
Weld	33,318	33,336	33,407	33,418	33,440	33,462	33,483	33,505	33,526	33,547	33,568

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:											
	6/24	6/25	6/26	6/27	6/29				7/1				7/3			
Adams	60,733	60,768	60,806	60,821	60,874	(12,175)	[2,922]	{1,461}	60,923	(12,185)	[2,924]	{1,462}	60,970	(12,194)	[2,927]	{1,463}
Arapahoe	62,584	62,625	62,674	62,694	62,758	(12,552)	[3,012]	{1,506}	62,821	(12,564)	[3,015]	{1,508}	62,881	(12,576)	[3,018]	{1,509}
Boulder	23,931	23,940	23,953	23,961	23,978	(4,796)	[1,151]	{575}	23,994	(4,799)	[1,152]	{576}	24,010	(4,802)	[1,152]	{576}
Denver	74,188	74,219	74,257	74,288	74,329	(14,866)	[3,568]	{1,784}	74,368	(14,874)	[3,570]	{1,785}	74,406	(14,881)	[3,571]	{1,786}
Douglas	30,408	30,418	30,445	30,459	30,512	(6,102)	[1,465]	{732}	30,565	(6,113)	[1,467]	{734}	30,617	(6,123)	[1,470]	{735}
Eagle	6,347	6,350	6,352	6,352	6,356	(1,271)	[305]	{153}	6,360	(1,272)	[305]	{153}	6,363	(1,273)	[305]	{153}
El Paso	72,986	73,042	73,143	73,176	73,295	(14,659)	[3,518]	{1,759}	73,406	(14,681)	[3,524]	{1,762}	73,510	(14,702)	[3,528]	{1,764}
Gunnison	1,382	1,385	1,392	1,391	1,395	(279)	[67]	{33}	1,400	(280)	[67]	{34}	1,406	(281)	[67]	{34}
Jefferson	48,744	48,779	48,833	48,850	48,893	(9,779)	[2,347]	{1,173}	48,937	(9,787)	[2,349]	{1,174}	48,978	(9,796)	[2,351]	{1,175}
Larimer	27,599	27,618	27,638	27,646	27,684	(5,537)	[1,329]	{664}	27,721	(5,544)	[1,331]	{665}	27,757	(5,551)	[1,332]	{666}
Pueblo	19,537	19,559	19,569	19,571	19,593	(3,919)	[940]	{470}	19,614	(3,923)	[941]	{471}	19,634	(3,927)	[942]	{471}
Weld	33,318	33,336	33,407	33,418	33,462	(6,692)	[1,606]	{803}	33,505	(6,701)	[1,608]	{804}	33,547	(6,709)	[1,610]	{805}

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.