

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 6/30/21**

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 6/30/21 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.

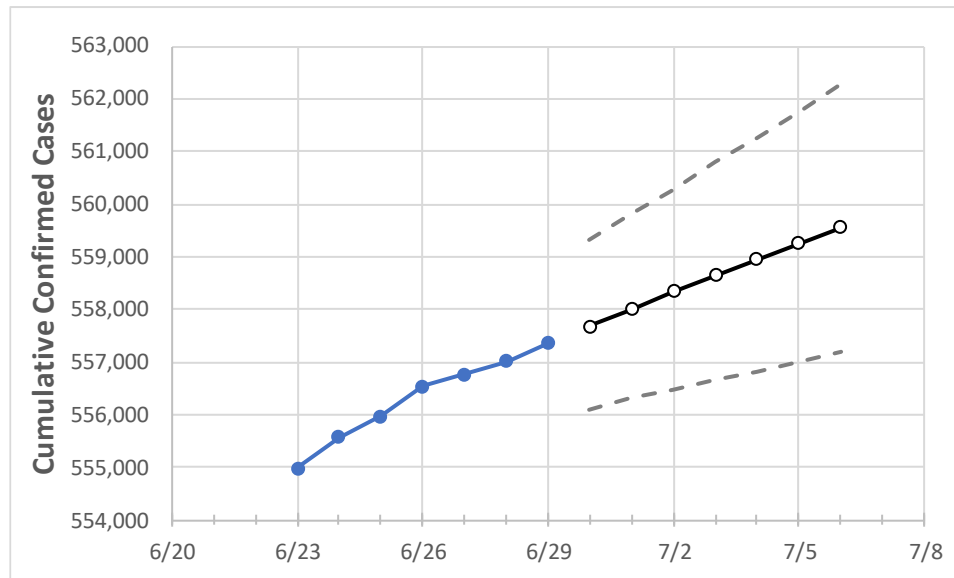
IEM's Modeling Lead

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:						
	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6
Colorado	556,542	556,775	557,004	557,347	557,684	558,010	558,334	558,640	558,946	559,248	559,557

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:						
	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6
Adams	60,806	60,821	60,838	60,867	60,892	60,915	60,939	60,961	60,983	61,005	61,025
Arapahoe	62,674	62,694	62,721	62,750	62,778	62,805	62,833	62,860	62,886	62,910	62,933
Boulder	23,953	23,961	23,968	23,982	23,992	24,001	24,011	24,021	24,030	24,040	24,050
Denver	74,257	74,288	74,297	74,315	74,334	74,351	74,368	74,385	74,401	74,416	74,431
Douglas	30,445	30,459	30,473	30,491	30,515	30,538	30,562	30,586	30,607	30,631	30,653
Eagle	6,352	6,353	6,353	6,354	6,355	6,357	6,358	6,359	6,361	6,362	6,363
El Paso	73,143	73,176	73,229	73,296	73,351	73,405	73,457	73,504	73,554	73,600	73,647
Gunnison	1,392	1,391	1,392	1,392	1,394	1,395	1,397	1,398	1,400	1,401	1,403
Jefferson	48,833	48,850	48,867	48,892	48,914	48,937	48,958	48,979	48,999	49,019	49,037
Larimer	27,638	27,646	27,659	27,676	27,694	27,711	27,728	27,745	27,761	27,777	27,793
Pueblo	19,569	19,571	19,573	19,581	19,591	19,600	19,609	19,618	19,626	19,634	19,642
Weld	33,407	33,418	33,430	33,451	33,472	33,493	33,513	33,533	33,552	33,572	33,591

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:											
	6/26	6/27	6/28	6/29	7/1				7/3				7/5			
Adams	60,806	60,821	60,838	60,867	60,915	(12,183)	[2,924]	{1,462}	60,961	(12,192)	[2,926]	{1,463}	61,005	(12,201)	[2,928]	{1,464}
Arapahoe	62,674	62,694	62,721	62,750	62,805	(12,561)	[3,015]	{1,507}	62,860	(12,572)	[3,017]	{1,509}	62,910	(12,582)	[3,020]	{1,510}
Boulder	23,953	23,961	23,968	23,982	24,001	(4,800)	[1,152]	{576}	24,021	(4,804)	[1,153]	{576}	24,040	(4,808)	[1,154]	{577}
Denver	74,257	74,288	74,297	74,315	74,351	(14,870)	[3,569]	{1,784}	74,385	(14,877)	[3,570]	{1,785}	74,416	(14,883)	[3,572]	{1,786}
Douglas	30,445	30,459	30,473	30,491	30,538	(6,108)	[1,466]	{733}	30,586	(6,117)	[1,468]	{734}	30,631	(6,126)	[1,470]	{735}
Eagle	6,352	6,353	6,353	6,354	6,357	(1,271)	[305]	{153}	6,359	(1,272)	[305]	{153}	6,362	(1,272)	[305]	{153}
El Paso	73,143	73,176	73,229	73,296	73,405	(14,681)	[3,523]	{1,762}	73,504	(14,701)	[3,528]	{1,764}	73,600	(14,720)	[3,533]	{1,766}
Gunnison	1,392	1,391	1,392	1,392	1,395	(279)	[67]	{33}	1,398	(280)	[67]	{34}	1,401	(280)	[67]	{34}
Jefferson	48,833	48,850	48,867	48,892	48,937	(9,787)	[2,349]	{1,174}	48,979	(9,796)	[2,351]	{1,175}	49,019	(9,804)	[2,353]	{1,176}
Larimer	27,638	27,646	27,659	27,676	27,711	(5,542)	[1,330]	{665}	27,745	(5,549)	[1,332]	{666}	27,777	(5,555)	[1,333]	{667}
Pueblo	19,569	19,571	19,573	19,581	19,600	(3,920)	[941]	{470}	19,618	(3,924)	[942]	{471}	19,634	(3,927)	[942]	{471}
Weld	33,407	33,418	33,430	33,451	33,493	(6,699)	[1,608]	{804}	33,533	(6,707)	[1,610]	{805}	33,572	(6,714)	[1,611]	{806}

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.