

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

Date: 6/22/21

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 6/22/21 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.

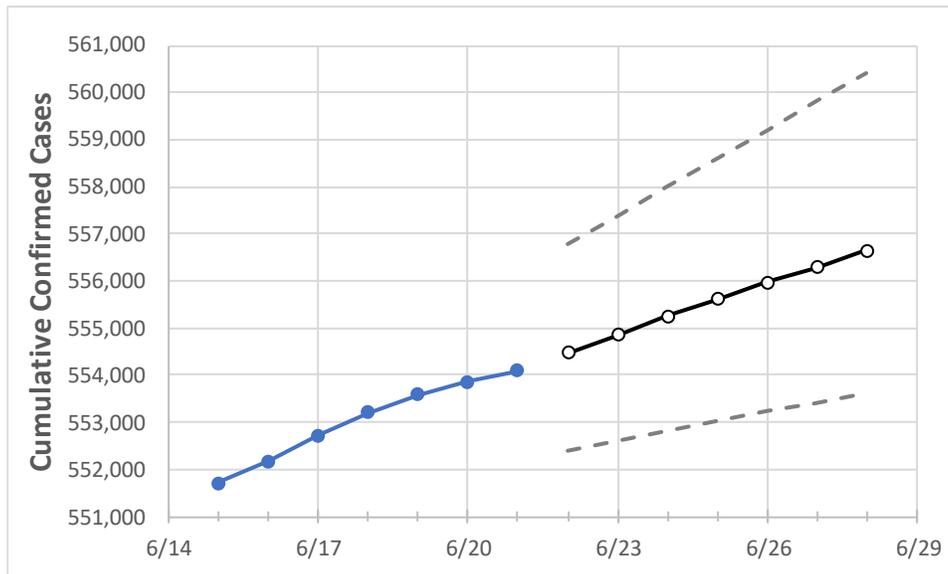
IEM's Modeling Lead

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:							
	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	
Colorado	553,200	553,596	553,868	554,090	554,484	554,862	555,251	555,617	555,964	556,296	556,638	

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:							
	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	
Adams	60,543	60,581	60,591	60,611	60,642	60,672	60,702	60,730	60,757	60,783	60,809	
Arapahoe	62,378	62,407	62,434	62,461	62,495	62,529	62,561	62,593	62,625	62,654	62,682	
Boulder	23,876	23,879	23,881	23,885	23,892	23,899	23,905	23,911	23,917	23,923	23,929	
Denver	74,041	74,068	74,081	74,091	74,129	74,165	74,200	74,233	74,266	74,298	74,328	
Douglas	30,216	30,231	30,244	30,255	30,280	30,307	30,331	30,355	30,379	30,403	30,427	
Eagle	6,342	6,342	6,341	6,341	6,344	6,347	6,350	6,354	6,357	6,361	6,365	
El Paso	72,570	72,635	72,694	72,736	72,816	72,891	72,966	73,038	73,109	73,179	73,244	
Gunnison	1,376	1,377	1,377	1,379	1,380	1,382	1,383	1,385	1,386	1,388	1,389	
Jefferson	48,615	48,650	48,666	48,678	48,703	48,728	48,751	48,775	48,797	48,819	48,841	
Larimer	27,461	27,485	27,501	27,510	27,531	27,552	27,572	27,592	27,612	27,631	27,651	
Pueblo	19,447	19,484	19,495	19,500	19,522	19,542	19,563	19,585	19,608	19,630	19,653	
Weld	33,186	33,208	33,223	33,234	33,253	33,271	33,289	33,305	33,322	33,337	33,352	

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:											
	6/18	6/19	6/20	6/21	6/23			6/25			6/27					
Adams	60,543	60,581	60,591	60,611	60,672	(12,134)	[2,912]	{1,456}	60,730	(12,146)	[2,915]	{1,458}	60,783	(12,157)	[2,918]	{1,459}
Arapahoe	62,378	62,407	62,434	62,461	62,529	(12,506)	[3,001]	{1,501}	62,593	(12,519)	[3,004]	{1,502}	62,654	(12,531)	[3,007]	{1,504}
Boulder	23,876	23,879	23,881	23,885	23,899	(4,780)	[1,147]	{574}	23,911	(4,782)	[1,148]	{574}	23,923	(4,785)	[1,148]	{574}
Denver	74,041	74,068	74,081	74,091	74,165	(14,833)	[3,560]	{1,780}	74,233	(14,847)	[3,563]	{1,782}	74,298	(14,860)	[3,566]	{1,783}
Douglas	30,216	30,231	30,244	30,255	30,307	(6,061)	[1,455]	{727}	30,355	(6,071)	[1,457]	{729}	30,403	(6,081)	[1,459]	{730}
Eagle	6,342	6,342	6,341	6,341	6,347	(1,269)	[305]	{152}	6,354	(1,271)	[305]	{152}	6,361	(1,272)	[305]	{153}
El Paso	72,570	72,635	72,694	72,736	72,891	(14,578)	[3,499]	{1,749}	73,038	(14,608)	[3,506]	{1,753}	73,179	(14,636)	[3,513]	{1,756}
Gunnison	1,376	1,377	1,377	1,379	1,382	(276)	[66]	{33}	1,385	(277)	[66]	{33}	1,388	(278)	[67]	{33}
Jefferson	48,615	48,650	48,666	48,678	48,728	(9,746)	[2,339]	{1,169}	48,775	(9,755)	[2,341]	{1,171}	48,819	(9,764)	[2,343]	{1,172}
Larimer	27,461	27,485	27,501	27,510	27,552	(5,510)	[1,322]	{661}	27,592	(5,518)	[1,324]	{662}	27,631	(5,526)	[1,326]	{663}
Pueblo	19,447	19,484	19,495	19,500	19,542	(3,908)	[938]	{469}	19,585	(3,917)	[940]	{470}	19,630	(3,926)	[942]	{471}
Weld	33,186	33,208	33,223	33,234	33,271	(6,654)	[1,597]	{799}	33,305	(6,661)	[1,599]	{799}	33,337	(6,667)	[1,600]	{800}

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.