

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

Date: 6/23/21

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 6/23/21 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.

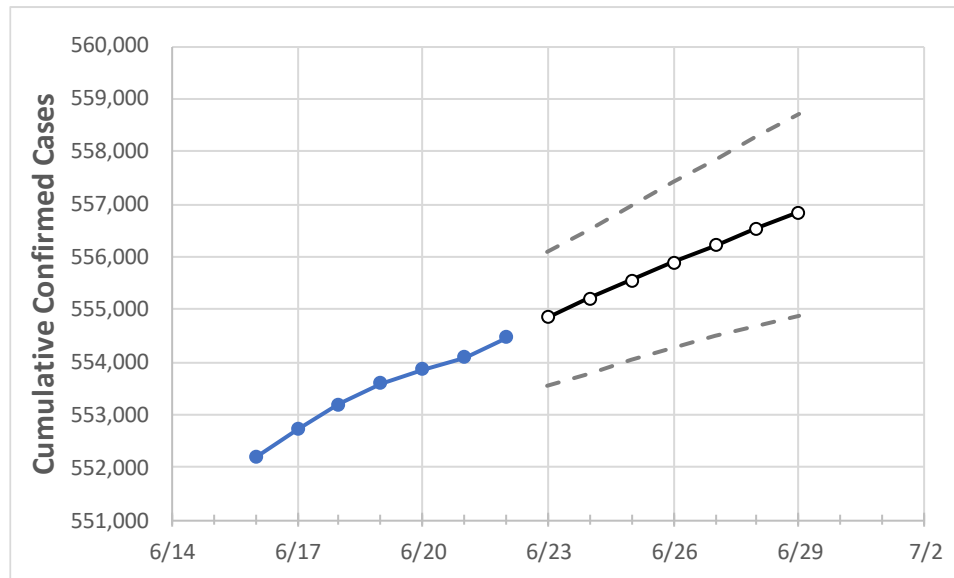
IEM's Modeling Lead

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:						
	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29
Colorado	553,596	553,868	554,090	554,473	554,849	555,209	555,556	555,891	556,223	556,540	556,843

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:						
	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29
Adams	60,581	60,591	60,611	60,655	60,685	60,715	60,743	60,771	60,799	60,825	60,851
Arapahoe	62,407	62,434	62,461	62,497	62,532	62,565	62,596	62,628	62,658	62,688	62,716
Boulder	23,879	23,881	23,885	23,897	23,904	23,911	23,917	23,924	23,930	23,935	23,941
Denver	74,068	74,081	74,091	74,115	74,148	74,181	74,212	74,243	74,273	74,302	74,331
Douglas	30,231	30,244	30,255	30,271	30,295	30,318	30,340	30,361	30,382	30,403	30,424
Eagle	6,342	6,341	6,341	6,344	6,347	6,350	6,353	6,356	6,359	6,362	6,365
El Paso	72,635	72,694	72,736	72,812	72,886	72,961	73,033	73,102	73,168	73,232	73,294
Gunnison	1,377	1,377	1,379	1,381	1,382	1,384	1,385	1,387	1,388	1,390	1,391
Jefferson	48,650	48,666	48,678	48,698	48,722	48,745	48,769	48,791	48,814	48,835	48,856
Larimer	27,485	27,501	27,510	27,537	27,559	27,579	27,600	27,621	27,641	27,662	27,681
Pueblo	19,484	19,495	19,500	19,513	19,534	19,554	19,575	19,596	19,616	19,637	19,658
Weld	33,208	33,223	33,234	33,256	33,274	33,292	33,308	33,324	33,340	33,354	33,369

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:											
	6/19	6/20	6/21	6/22	6/24				6/26				6/28			
Adams	60,581	60,591	60,611	60,655	60,715	(12,143)	[2,914]	{1,457}	60,771	(12,154)	[2,917]	{1,459}	60,825	(12,165)	[2,920]	{1,460}
Arapahoe	62,407	62,434	62,461	62,497	62,565	(12,513)	[3,003]	{1,502}	62,628	(12,526)	[3,006]	{1,503}	62,688	(12,538)	[3,009]	{1,505}
Boulder	23,879	23,881	23,885	23,897	23,911	(4,782)	[1,148]	{574}	23,924	(4,785)	[1,148]	{574}	23,935	(4,787)	[1,149]	{574}
Denver	74,068	74,081	74,091	74,115	74,181	(14,836)	[3,561]	{1,780}	74,243	(14,849)	[3,564]	{1,782}	74,302	(14,860)	[3,566]	{1,783}
Douglas	30,231	30,244	30,255	30,271	30,318	(6,064)	[1,455]	{728}	30,361	(6,072)	[1,457]	{729}	30,403	(6,081)	[1,459]	{730}
Eagle	6,342	6,341	6,341	6,344	6,350	(1,270)	[305]	{152}	6,356	(1,271)	[305]	{153}	6,362	(1,272)	[305]	{153}
El Paso	72,635	72,694	72,736	72,812	72,961	(14,592)	[3,502]	{1,751}	73,102	(14,620)	[3,509]	{1,754}	73,232	(14,646)	[3,515]	{1,758}
Gunnison	1,377	1,377	1,379	1,381	1,384	(277)	[66]	{33}	1,387	(277)	[67]	{33}	1,390	(278)	[67]	{33}
Jefferson	48,650	48,666	48,678	48,698	48,745	(9,749)	[2,340]	{1,170}	48,791	(9,758)	[2,342]	{1,171}	48,835	(9,767)	[2,344]	{1,172}
Larimer	27,485	27,501	27,510	27,537	27,579	(5,516)	[1,324]	{662}	27,621	(5,524)	[1,326]	{663}	27,662	(5,532)	[1,328]	{664}
Pueblo	19,484	19,495	19,500	19,513	19,554	(3,911)	[939]	{469}	19,596	(3,919)	[941]	{470}	19,637	(3,927)	[943]	{471}
Weld	33,208	33,223	33,234	33,256	33,292	(6,658)	[1,598]	{799}	33,324	(6,665)	[1,600]	{800}	33,354	(6,671)	[1,601]	{801}

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.