

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 5/19/21**

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 5/19/21 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.

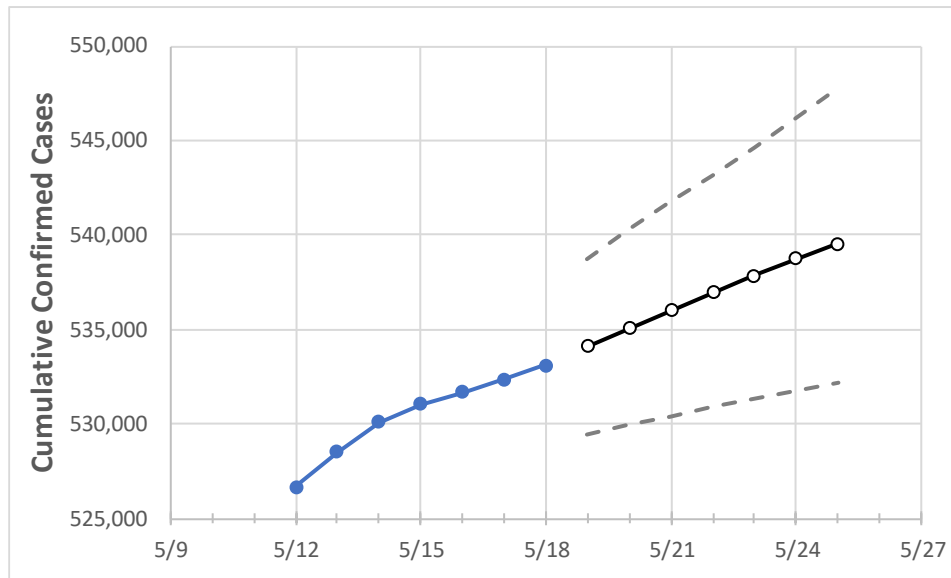
IEM's Modeling Lead

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:							
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	
Colorado	531,070	531,700	532,389	533,119	534,096	535,070	535,998	536,944	537,854	538,734	539,563	

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:							
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	
Adams	58,584	58,669	58,722	58,802	58,930	59,061	59,184	59,314	59,438	59,558	59,682	
Arapahoe	60,071	60,158	60,214	60,297	60,422	60,546	60,665	60,785	60,899	61,010	61,121	
Boulder	23,389	23,396	23,412	23,425	23,443	23,459	23,474	23,489	23,503	23,517	23,530	
Denver	72,279	72,338	72,378	72,418	72,495	72,569	72,639	72,707	72,773	72,842	72,905	
Douglas	28,952	28,967	29,011	29,036	29,080	29,122	29,162	29,199	29,233	29,269	29,302	
Eagle	6,295	6,297	6,298	6,298	6,301	6,304	6,306	6,309	6,311	6,313	6,316	
El Paso	67,582	67,698	67,882	68,078	68,277	68,475	68,669	68,854	69,041	69,223	69,405	
Gunnison	1,343	1,344	1,345	1,346	1,347	1,349	1,350	1,351	1,353	1,354	1,356	
Jefferson	47,073	47,148	47,193	47,258	47,352	47,444	47,538	47,627	47,715	47,802	47,885	
Larimer	26,461	26,483	26,539	26,572	26,618	26,664	26,709	26,753	26,794	26,835	26,873	
Pueblo	18,724	18,747	18,770	18,786	18,807	18,825	18,843	18,860	18,875	18,888	18,900	
Weld	31,799	31,829	31,890	31,944	32,014	32,082	32,148	32,211	32,274	32,336	32,397	

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:											
	5/15	5/16	5/17	5/18	5/20				5/22				5/24			
Adams	58,584	58,669	58,722	58,802	59,061	(11,812)	[2,835]	{1,417}	59,314	(11,863)	[2,847]	{1,424}	59,558	(11,912)	[2,859]	{1,429}
Arapahoe	60,071	60,158	60,214	60,297	60,546	(12,109)	[2,906]	{1,453}	60,785	(12,157)	[2,918]	{1,459}	61,010	(12,202)	[2,928]	{1,464}
Boulder	23,389	23,396	23,412	23,425	23,459	(4,692)	[1,126]	{563}	23,489	(4,698)	[1,127]	{564}	23,517	(4,703)	[1,129]	{564}
Denver	72,279	72,338	72,378	72,418	72,569	(14,514)	[3,483]	{1,742}	72,707	(14,541)	[3,490]	{1,745}	72,842	(14,568)	[3,496]	{1,748}
Douglas	28,952	28,967	29,011	29,036	29,122	(5,824)	[1,398]	{699}	29,199	(5,840)	[1,402]	{701}	29,269	(5,854)	[1,405]	{702}
Eagle	6,295	6,297	6,298	6,298	6,304	(1,261)	[303]	{151}	6,309	(1,262)	[303]	{151}	6,313	(1,263)	[303]	{152}
El Paso	67,582	67,698	67,882	68,078	68,475	(13,695)	[3,287]	{1,643}	68,854	(13,771)	[3,305]	{1,652}	69,223	(13,845)	[3,323]	{1,661}
Gunnison	1,343	1,344	1,345	1,346	1,349	(270)	[65]	{32}	1,351	(270)	[65]	{32}	1,354	(271)	[65]	{33}
Jefferson	47,073	47,148	47,193	47,258	47,444	(9,489)	[2,277]	{1,139}	47,627	(9,525)	[2,286]	{1,143}	47,802	(9,560)	[2,295]	{1,147}
Larimer	26,461	26,483	26,539	26,572	26,664	(5,333)	[1,280]	{640}	26,753	(5,351)	[1,284]	{642}	26,835	(5,367)	[1,288]	{644}
Pueblo	18,724	18,747	18,770	18,786	18,825	(3,765)	[904]	{452}	18,860	(3,772)	[905]	{453}	18,888	(3,778)	[907]	{453}
Weld	31,799	31,829	31,890	31,944	32,082	(6,416)	[1,540]	{770}	32,211	(6,442)	[1,546]	{773}	32,336	(6,467)	[1,552]	{776}

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.