

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

Date: 10/25/21

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 10/25/21 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.

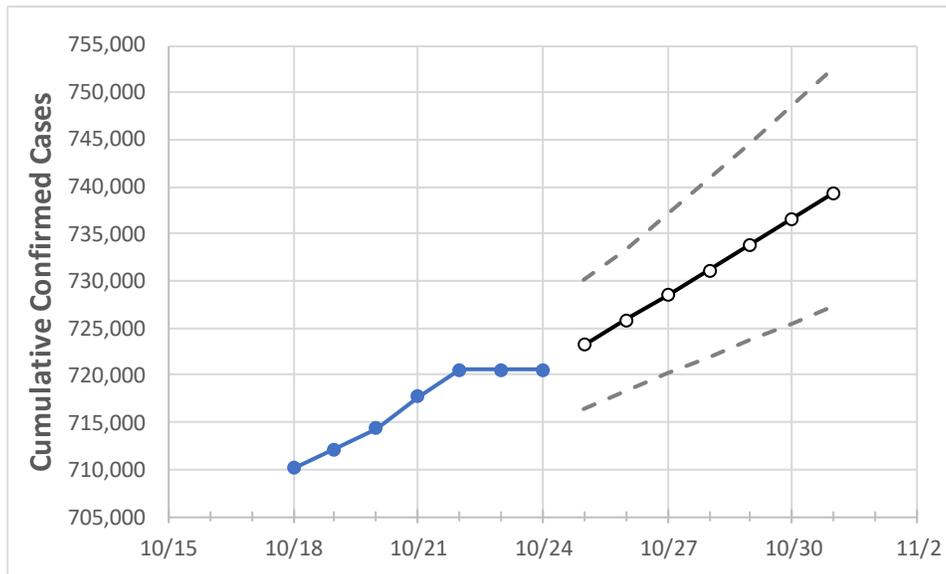
IEM's Modeling Lead

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:						
	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31
Colorado	717,774	720,620	720,620	720,620	723,222	725,814	728,509	731,142	733,851	736,639	739,308

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:						
	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31
Adams	74,413	74,660	74,660	74,660	74,882	75,106	75,337	75,566	75,808	76,055	76,302
Arapahoe	78,280	78,521	78,521	78,521	78,741	78,966	79,188	79,412	79,637	79,869	80,103
Boulder	30,278	30,369	30,369	30,369	30,449	30,523	30,602	30,681	30,759	30,837	30,913
Denver	90,001	90,270	90,270	90,270	90,484	90,705	90,917	91,140	91,358	91,582	91,807
Douglas	39,616	39,740	39,740	39,740	39,855	39,967	40,077	40,195	40,310	40,421	40,534
Eagle	8,246	8,268	8,268	8,268	8,290	8,312	8,334	8,358	8,381	8,406	8,431
El Paso	99,178	99,562	99,562	99,562	99,936	100,317	100,698	101,082	101,470	101,864	102,241
Gunnison	1,814	1,817	1,817	1,817	1,819	1,821	1,823	1,825	1,827	1,829	1,831
Jefferson	61,832	62,065	62,065	62,065	62,267	62,478	62,687	62,901	63,114	63,336	63,556
Larimer	38,248	38,435	38,435	38,435	38,608	38,784	38,955	39,129	39,321	39,504	39,684
Pueblo	24,532	24,665	24,665	24,665	24,787	24,913	25,037	25,164	25,298	25,432	25,567
Weld	45,411	45,666	45,666	45,666	45,873	46,073	46,279	46,489	46,698	46,916	47,136

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:											
	10/21	10/22	10/23	10/24	10/26		10/28		10/30		10/30		10/30			
Adams	74,413	74,660	74,660	74,660	75,106	(15,021)	[3,605]	{1,803}	75,566	(15,113)	[3,627]	{1,814}	76,055	(15,211)	[3,651]	{1,825}
Arapahoe	78,280	78,521	78,521	78,521	78,966	(15,793)	[3,790]	{1,895}	79,412	(15,882)	[3,812]	{1,906}	79,869	(15,974)	[3,834]	{1,917}
Boulder	30,278	30,369	30,369	30,369	30,523	(6,105)	[1,465]	{733}	30,681	(6,136)	[1,473]	{736}	30,837	(6,167)	[1,480]	{740}
Denver	90,001	90,270	90,270	90,270	90,705	(18,141)	[4,354]	{2,177}	91,140	(18,228)	[4,375]	{2,187}	91,582	(18,316)	[4,396]	{2,198}
Douglas	39,616	39,740	39,740	39,740	39,967	(7,993)	[1,918]	{959}	40,195	(8,039)	[1,929]	{965}	40,421	(8,084)	[1,940]	{970}
Eagle	8,246	8,268	8,268	8,268	8,312	(1,662)	[399]	{199}	8,358	(1,672)	[401]	{201}	8,406	(1,681)	[404]	{202}
El Paso	99,178	99,562	99,562	99,562	100,317	(20,063)	[4,815]	{2,408}	101,082	(20,216)	[4,852]	{2,426}	101,864	(20,373)	[4,889]	{2,445}
Gunnison	1,814	1,817	1,817	1,817	1,821	(364)	[87]	{44}	1,825	(365)	[88]	{44}	1,829	(366)	[88]	{44}
Jefferson	61,832	62,065	62,065	62,065	62,478	(12,496)	[2,999]	{1,499}	62,901	(12,580)	[3,019]	{1,510}	63,336	(12,667)	[3,040]	{1,520}
Larimer	38,248	38,435	38,435	38,435	38,784	(7,757)	[1,862]	{931}	39,129	(7,826)	[1,878]	{939}	39,504	(7,901)	[1,896]	{948}
Pueblo	24,532	24,665	24,665	24,665	24,913	(4,983)	[1,196]	{598}	25,164	(5,033)	[1,208]	{604}	25,432	(5,086)	[1,221]	{610}
Weld	45,411	45,666	45,666	45,666	46,073	(9,215)	[2,212]	{1,106}	46,489	(9,298)	[2,231]	{1,116}	46,916	(9,383)	[2,252]	{1,126}

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.