

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

**Date: 3/1/21**

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 3/1/21 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.**

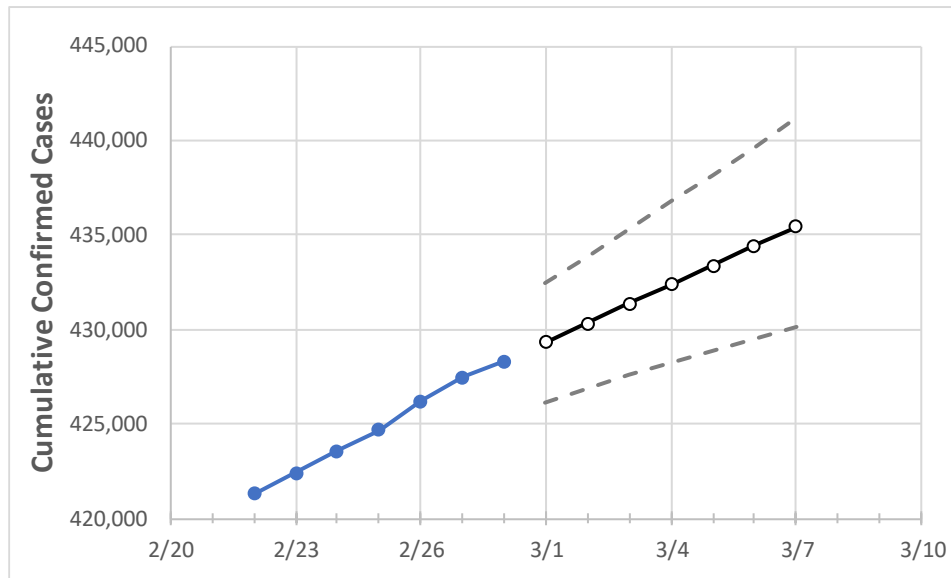
### **IEM's Modeling Lead**

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:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
Colorado	424,677	426,198	427,462	428,303	429,329	430,341	431,352	432,395	433,400	434,426	435,429

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:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
Adams	48,067	48,214	48,340	48,413	48,516	48,619	48,728	48,836	48,941	49,050	49,159
Arapahoe	48,075	48,248	48,384	48,463	48,575	48,689	48,803	48,916	49,030	49,141	49,255
Boulder	18,640	18,714	18,762	18,799	18,844	18,888	18,931	18,974	19,015	19,054	19,095
Denver	59,086	59,320	59,506	59,584	59,717	59,851	59,981	60,113	60,250	60,384	60,520
Douglas	21,048	21,162	21,272	21,327	21,399	21,468	21,537	21,606	21,677	21,743	21,809
Eagle	4,997	5,022	5,045	5,065	5,089	5,113	5,137	5,161	5,186	5,210	5,235
El Paso	51,543	51,709	51,849	51,975	52,113	52,253	52,389	52,528	52,671	52,814	52,955
Gunnison	1,199	1,201	1,202	1,203	1,205	1,207	1,209	1,211	1,213	1,215	1,217
Jefferson	36,851	37,003	37,111	37,202	37,301	37,401	37,505	37,609	37,714	37,820	37,929
Larimer	19,811	19,917	19,999	20,072	20,151	20,234	20,315	20,396	20,477	20,560	20,642
Pueblo	14,945	14,970	14,995	15,007	15,018	15,028	15,038	15,047	15,055	15,063	15,073
Weld	25,283	25,346	25,410	25,465	25,525	25,588	25,647	25,708	25,769	25,831	25,893

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:											
	2/25	2/26	2/27	2/28	3/2				3/4				3/6			
Adams	48,067	48,214	48,340	48,413	48,619	(9,724)	[2,334]	{1,167}	48,836	(9,767)	[2,344]	{1,172}	49,050	(9,810)	[2,354]	{1,177}
Arapahoe	48,075	48,248	48,384	48,463	48,689	(9,738)	[2,337]	{1,169}	48,916	(9,783)	[2,348]	{1,174}	49,141	(9,828)	[2,359]	{1,179}
Boulder	18,640	18,714	18,762	18,799	18,888	(3,778)	[907]	{453}	18,974	(3,795)	[911]	{455}	19,054	(3,811)	[915]	{457}
Denver	59,086	59,320	59,506	59,584	59,851	(11,970)	[2,873]	{1,436}	60,113	(12,023)	[2,885]	{1,443}	60,384	(12,077)	[2,898]	{1,449}
Douglas	21,048	21,162	21,272	21,327	21,468	(4,294)	[1,030]	{515}	21,606	(4,321)	[1,037]	{519}	21,743	(4,349)	[1,044]	{522}
Eagle	4,997	5,022	5,045	5,065	5,113	(1,023)	[245]	{123}	5,161	(1,032)	[248]	{124}	5,210	(1,042)	[250]	{125}
El Paso	51,543	51,709	51,849	51,975	52,253	(10,451)	[2,508]	{1,254}	52,528	(10,506)	[2,521]	{1,261}	52,814	(10,563)	[2,535]	{1,268}
Gunnison	1,199	1,201	1,202	1,203	1,207	(241)	[58]	{29}	1,211	(242)	[58]	{29}	1,215	(243)	[58]	{29}
Jefferson	36,851	37,003	37,111	37,202	37,401	(7,480)	[1,795]	{898}	37,609	(7,522)	[1,805]	{903}	37,820	(7,564)	[1,815]	{908}
Larimer	19,811	19,917	19,999	20,072	20,234	(4,047)	[971]	{486}	20,396	(4,079)	[979]	{490}	20,560	(4,112)	[987]	{493}
Pueblo	14,945	14,970	14,995	15,007	15,028	(3,006)	[721]	{361}	15,047	(3,009)	[722]	{361}	15,063	(3,013)	[723]	{362}
Weld	25,283	25,346	25,410	25,465	25,588	(5,118)	[1,228]	{614}	25,708	(5,142)	[1,234]	{617}	25,831	(5,166)	[1,240]	{620}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.