

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

**Date: 2/10/21**

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 2/10/21 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.**

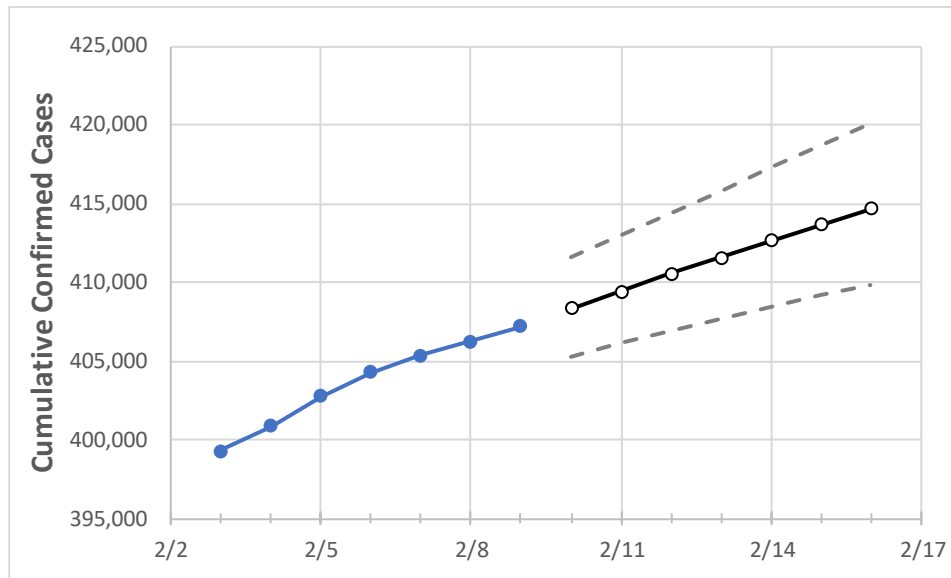
### **IEM's Modeling Lead**

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Colorado	404,256	405,330	406,276	407,210	408,341	409,427	410,529	411,572	412,611	413,654	414,654

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Adams	46,398	46,481	46,547	46,609	46,698	46,789	46,873	46,955	47,036	47,114	47,191
Arapahoe	45,911	46,021	46,138	46,245	46,367	46,489	46,613	46,730	46,846	46,962	47,072
Boulder	17,589	17,646	17,706	17,756	17,813	17,868	17,924	17,978	18,031	18,085	18,136
Denver	56,574	56,677	56,844	56,997	57,127	57,258	57,384	57,507	57,633	57,757	57,874
Douglas	19,582	19,668	19,739	19,813	19,909	20,006	20,105	20,202	20,302	20,400	20,497
Eagle	4,578	4,598	4,621	4,635	4,656	4,677	4,698	4,717	4,736	4,756	4,775
El Paso	48,740	48,851	48,961	49,081	49,211	49,339	49,464	49,590	49,716	49,837	49,958
Gunnison	1,082	1,086	1,089	1,091	1,094	1,097	1,099	1,102	1,104	1,106	1,108
Jefferson	35,181	35,284	35,360	35,433	35,519	35,604	35,685	35,767	35,846	35,922	35,998
Larimer	18,516	18,564	18,622	18,669	18,732	18,794	18,857	18,916	18,973	19,030	19,088
Pueblo	14,426	14,441	14,449	14,452	14,465	14,477	14,488	14,499	14,510	14,520	14,531
Weld	24,090	24,185	24,247	24,310	24,380	24,448	24,517	24,584	24,653	24,720	24,786

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:											
	2/6	2/7	2/8	2/9	2/11				2/13				2/15			
Adams	46,398	46,481	46,547	46,609	46,789	(9,358)	[2,246]	{1,123}	46,955	(9,391)	[2,254]	{1,127}	47,114	(9,423)	[2,261]	{1,131}
Arapahoe	45,911	46,021	46,138	46,245	46,489	(9,298)	[2,231]	{1,116}	46,730	(9,346)	[2,243]	{1,122}	46,962	(9,392)	[2,254]	{1,127}
Boulder	17,589	17,646	17,706	17,756	17,868	(3,574)	[858]	{429}	17,978	(3,596)	[863]	{431}	18,085	(3,617)	[868]	{434}
Denver	56,574	56,677	56,844	56,997	57,258	(11,452)	[2,748]	{1,374}	57,507	(11,501)	[2,760]	{1,380}	57,757	(11,551)	[2,772]	{1,386}
Douglas	19,582	19,668	19,739	19,813	20,006	(4,001)	[960]	{480}	20,202	(4,040)	[970]	{485}	20,400	(4,080)	[979]	{490}
Eagle	4,578	4,598	4,621	4,635	4,677	(935)	[224]	{112}	4,717	(943)	[226]	{113}	4,756	(951)	[228]	{114}
El Paso	48,740	48,851	48,961	49,081	49,339	(9,868)	[2,368]	{1,184}	49,590	(9,918)	[2,380]	{1,190}	49,837	(9,967)	[2,392]	{1,196}
Gunnison	1,082	1,086	1,089	1,091	1,097	(219)	[53]	{26}	1,102	(220)	[53]	{26}	1,106	(221)	[53]	{27}
Jefferson	35,181	35,284	35,360	35,433	35,604	(7,121)	[1,709]	{854}	35,767	(7,153)	[1,717]	{858}	35,922	(7,184)	[1,724]	{862}
Larimer	18,516	18,564	18,622	18,669	18,794	(3,759)	[902]	{451}	18,916	(3,783)	[908]	{454}	19,030	(3,806)	[913]	{457}
Pueblo	14,426	14,441	14,449	14,452	14,477	(2,895)	[695]	{347}	14,499	(2,900)	[696]	{348}	14,520	(2,904)	[697]	{348}
Weld	24,090	24,185	24,247	24,310	24,448	(4,890)	[1,173]	{587}	24,584	(4,917)	[1,180]	{590}	24,720	(4,944)	[1,187]	{593}

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.