

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

**Date: 2/3/21**

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 2/3/21 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.**

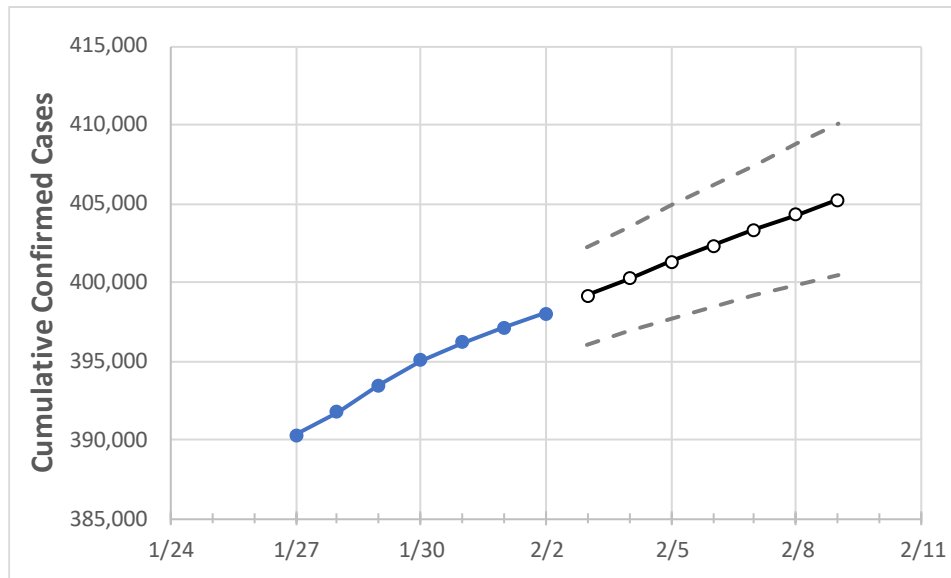
### **IEM's Modeling Lead**

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:							
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	
Colorado	395,019	396,185	397,101	398,037	399,166	400,246	401,295	402,311	403,315	404,282	405,228	

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:							
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	
Adams	45,618	45,735	45,807	45,871	45,968	46,060	46,149	46,234	46,318	46,398	46,477	
Arapahoe	44,881	45,027	45,154	45,243	45,373	45,501	45,624	45,748	45,865	45,980	46,093	
Boulder	17,179	17,224	17,263	17,298	17,352	17,404	17,457	17,508	17,559	17,606	17,653	
Denver	55,588	55,734	55,835	55,910	56,035	56,155	56,271	56,381	56,488	56,597	56,697	
Douglas	18,861	18,920	19,029	19,096	19,163	19,229	19,292	19,356	19,417	19,476	19,534	
Eagle	4,375	4,390	4,402	4,427	4,449	4,472	4,493	4,514	4,534	4,554	4,573	
El Paso	47,657	47,777	47,842	47,933	48,032	48,129	48,225	48,313	48,401	48,482	48,562	
Gunnison	1,051	1,054	1,056	1,061	1,069	1,078	1,086	1,093	1,101	1,108	1,115	
Jefferson	34,509	34,593	34,665	34,737	34,825	34,913	34,998	35,078	35,156	35,235	35,307	
Larimer	17,999	18,065	18,115	18,160	18,226	18,294	18,359	18,422	18,484	18,547	18,610	
Pueblo	14,326	14,339	14,353	14,353	14,371	14,389	14,405	14,422	14,438	14,453	14,469	
Weld	23,523	23,586	23,640	23,779	23,842	23,902	23,962	24,020	24,076	24,129	24,180	

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:											
	1/30	1/31	2/1	2/2	2/4				2/6				2/8			
Adams	45,618	45,735	45,807	45,871	46,060	(9,212)	[2,211]	{1,105}	46,234	(9,247)	[2,219]	{1,110}	46,398	(9,280)	[2,227]	{1,114}
Arapahoe	44,881	45,027	45,154	45,243	45,501	(9,100)	[2,184]	{1,092}	45,748	(9,150)	[2,196]	{1,098}	45,980	(9,196)	[2,207]	{1,104}
Boulder	17,179	17,224	17,263	17,298	17,404	(3,481)	[835]	{418}	17,508	(3,502)	[840]	{420}	17,606	(3,521)	[845]	{423}
Denver	55,588	55,734	55,835	55,910	56,155	(11,231)	[2,695]	{1,348}	56,381	(11,276)	[2,706]	{1,353}	56,597	(11,319)	[2,717]	{1,358}
Douglas	18,861	18,920	19,029	19,096	19,229	(3,846)	[923]	{461}	19,356	(3,871)	[929]	{465}	19,476	(3,895)	[935]	{467}
Eagle	4,375	4,390	4,402	4,427	4,472	(894)	[215]	{107}	4,514	(903)	[217]	{108}	4,554	(911)	[219]	{109}
El Paso	47,657	47,777	47,842	47,933	48,129	(9,626)	[2,310]	{1,155}	48,313	(9,663)	[2,319]	{1,160}	48,482	(9,696)	[2,327]	{1,164}
Gunnison	1,051	1,054	1,056	1,061	1,078	(216)	[52]	{26}	1,093	(219)	[52]	{26}	1,108	(222)	[53]	{27}
Jefferson	34,509	34,593	34,665	34,737	34,913	(6,983)	[1,676]	{838}	35,078	(7,016)	[1,684]	{842}	35,235	(7,047)	[1,691]	{846}
Larimer	17,999	18,065	18,115	18,160	18,294	(3,659)	[878]	{439}	18,422	(3,684)	[884]	{442}	18,547	(3,709)	[890]	{445}
Pueblo	14,326	14,339	14,353	14,353	14,389	(2,878)	[691]	{345}	14,422	(2,884)	[692]	{346}	14,453	(2,891)	[694]	{347}
Weld	23,523	23,586	23,640	23,779	23,902	(4,780)	[1,147]	{574}	24,020	(4,804)	[1,153]	{576}	24,129	(4,826)	[1,158]	{579}

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.