

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

Date: 2/25/21

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 2/25/21 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.**

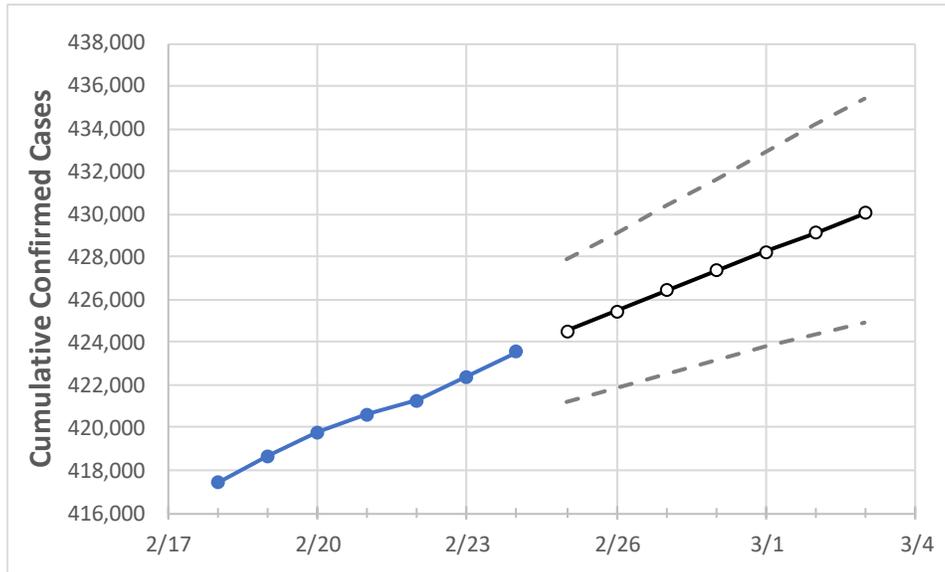
### IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Colorado	420,614	421,294	422,390	423,558	424,528	425,470	426,424	427,341	428,251	429,144	430,032

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Adams	47,716	47,787	47,861	47,974	48,055	48,139	48,223	48,305	48,387	48,464	48,543
Arapahoe	47,644	47,734	47,849	47,979	48,082	48,180	48,281	48,377	48,475	48,564	48,659
Boulder	18,476	18,515	18,548	18,598	18,648	18,697	18,748	18,797	18,844	18,890	18,936
Denver	58,534	58,582	58,778	58,937	59,058	59,172	59,287	59,402	59,514	59,625	59,737
Douglas	20,776	20,827	20,902	20,970	21,039	21,107	21,175	21,240	21,307	21,372	21,436
Eagle	4,897	4,907	4,940	4,970	4,991	5,012	5,032	5,053	5,073	5,094	5,115
El Paso	50,951	51,036	51,210	51,389	51,542	51,693	51,845	51,995	52,149	52,307	52,457
Gunnison	1,181	1,182	1,192	1,198	1,204	1,210	1,216	1,222	1,228	1,234	1,240
Jefferson	36,523	36,588	36,660	36,750	36,824	36,898	36,974	37,043	37,111	37,181	37,247
Larimer	19,532	19,594	19,663	19,745	19,816	19,886	19,956	20,025	20,096	20,166	20,235
Pueblo	14,879	14,881	14,900	14,907	14,933	14,960	14,987	15,013	15,040	15,066	15,093
Weld	25,018	25,061	25,142	25,212	25,266	25,318	25,370	25,421	25,471	25,519	25,566

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:											
	2/21	2/22	2/23	2/24	2/26			2/28			3/2					
Adams	47,716	47,787	47,861	47,974	48,139	(9,628)	[2,311]	{1,155}	48,305	(9,661)	[2,319]	{1,159}	48,464	(9,693)	[2,326]	{1,163}
Arapahoe	47,644	47,734	47,849	47,979	48,180	(9,636)	[2,313]	{1,156}	48,377	(9,675)	[2,322]	{1,161}	48,564	(9,713)	[2,331]	{1,166}
Boulder	18,476	18,515	18,548	18,598	18,697	(3,739)	[897]	{449}	18,797	(3,759)	[902]	{451}	18,890	(3,778)	[907]	{453}
Denver	58,534	58,582	58,778	58,937	59,172	(11,834)	[2,840]	{1,420}	59,402	(11,880)	[2,851]	{1,426}	59,625	(11,925)	[2,862]	{1,431}
Douglas	20,776	20,827	20,902	20,970	21,107	(4,221)	[1,013]	{507}	21,240	(4,248)	[1,020]	{510}	21,372	(4,274)	[1,026]	{513}
Eagle	4,897	4,907	4,940	4,970	5,012	(1,002)	[241]	{120}	5,053	(1,011)	[243]	{121}	5,094	(1,019)	[245]	{122}
El Paso	50,951	51,036	51,210	51,389	51,693	(10,339)	[2,481]	{1,241}	51,995	(10,399)	[2,496]	{1,248}	52,307	(10,461)	[2,511]	{1,255}
Gunnison	1,181	1,182	1,192	1,198	1,210	(242)	[58]	{29}	1,222	(244)	[59]	{29}	1,234	(247)	[59]	{30}
Jefferson	36,523	36,588	36,660	36,750	36,898	(7,380)	[1,771]	{886}	37,043	(7,409)	[1,778]	{889}	37,181	(7,436)	[1,785]	{892}
Larimer	19,532	19,594	19,663	19,745	19,886	(3,977)	[955]	{477}	20,025	(4,005)	[961]	{481}	20,166	(4,033)	[968]	{484}
Pueblo	14,879	14,881	14,900	14,907	14,960	(2,992)	[718]	{359}	15,013	(3,003)	[721]	{360}	15,066	(3,013)	[723]	{362}
Weld	25,018	25,061	25,142	25,212	25,318	(5,064)	[1,215]	{608}	25,421	(5,084)	[1,220]	{610}	25,519	(5,104)	[1,225]	{612}

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.