

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

Date: 2/5/21

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 2/5/21 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.**

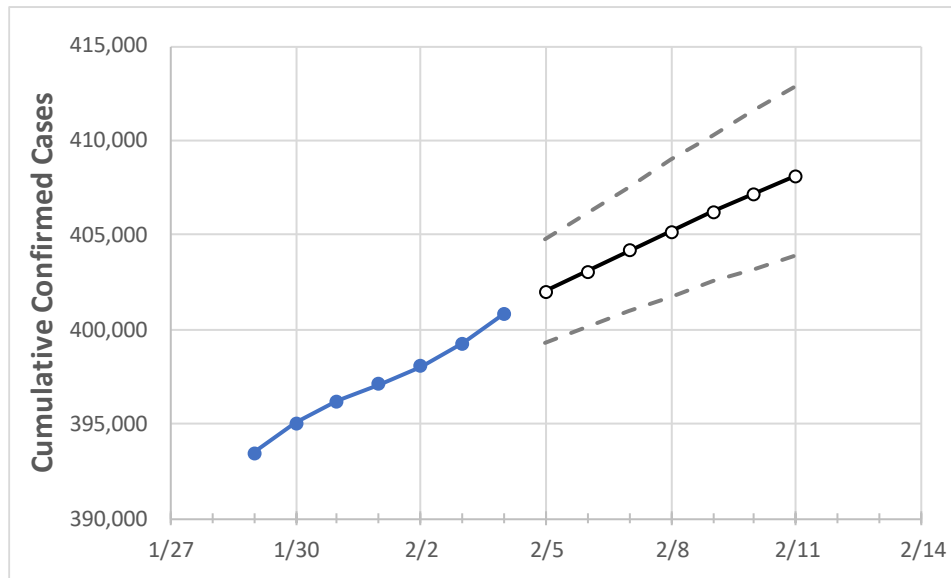
### IEM's Modeling Lead

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:						
	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
Colorado	397,101	398,037	399,267	400,851	401,987	403,077	404,154	405,151	406,215	407,185	408,146

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:						
	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
Adams	45,807	45,871	45,982	46,098	46,193	46,285	46,374	46,461	46,544	46,625	46,705
Arapahoe	45,154	45,243	45,359	45,545	45,674	45,799	45,918	46,038	46,153	46,266	46,374
Boulder	17,263	17,298	17,369	17,437	17,493	17,547	17,601	17,653	17,705	17,755	17,805
Denver	55,835	55,910	56,051	56,202	56,320	56,433	56,547	56,655	56,755	56,857	56,956
Douglas	19,029	19,096	19,205	19,314	19,389	19,464	19,537	19,610	19,680	19,750	19,818
Eagle	4,402	4,427	4,479	4,522	4,552	4,582	4,612	4,642	4,672	4,704	4,734
El Paso	47,842	47,933	48,056	48,227	48,332	48,435	48,532	48,628	48,724	48,815	48,905
Gunnison	1,056	1,061	1,069	1,075	1,082	1,089	1,096	1,103	1,109	1,115	1,121
Jefferson	34,665	34,737	34,827	34,966	35,059	35,149	35,237	35,323	35,405	35,486	35,565
Larimer	18,115	18,160	18,246	18,341	18,410	18,477	18,545	18,610	18,676	18,741	18,804
Pueblo	14,353	14,367	14,381	14,389	14,404	14,418	14,432	14,445	14,458	14,471	14,483
Weld	23,640	23,779	23,841	23,919	23,987	24,055	24,121	24,185	24,248	24,312	24,373

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:											
	2/1	2/2	2/3	2/4	2/6				2/8				2/10			
Adams	45,807	45,871	45,982	46,098	46,285	(9,257)	[2,222]	{1,111}	46,461	(9,292)	[2,230]	{1,115}	46,625	(9,325)	[2,238]	{1,119}
Arapahoe	45,154	45,243	45,359	45,545	45,799	(9,160)	[2,198]	{1,099}	46,038	(9,208)	[2,210]	{1,105}	46,266	(9,253)	[2,221]	{1,110}
Boulder	17,263	17,298	17,369	17,437	17,547	(3,509)	[842]	{421}	17,653	(3,531)	[847]	{424}	17,755	(3,551)	[852]	{426}
Denver	55,835	55,910	56,051	56,202	56,433	(11,287)	[2,709]	{1,354}	56,655	(11,331)	[2,719]	{1,360}	56,857	(11,371)	[2,729]	{1,365}
Douglas	19,029	19,096	19,205	19,314	19,464	(3,893)	[934]	{467}	19,610	(3,922)	[941]	{471}	19,750	(3,950)	[948]	{474}
Eagle	4,402	4,427	4,479	4,522	4,582	(916)	[220]	{110}	4,642	(928)	[223]	{111}	4,704	(941)	[226]	{113}
El Paso	47,842	47,933	48,056	48,227	48,435	(9,687)	[2,325]	{1,162}	48,628	(9,726)	[2,334]	{1,167}	48,815	(9,763)	[2,343]	{1,172}
Gunnison	1,056	1,061	1,069	1,075	1,089	(218)	[52]	{26}	1,103	(221)	[53]	{26}	1,115	(223)	[54]	{27}
Jefferson	34,665	34,737	34,827	34,966	35,149	(7,030)	[1,687]	{844}	35,323	(7,065)	[1,695]	{848}	35,486	(7,097)	[1,703]	{852}
Larimer	18,115	18,160	18,246	18,341	18,477	(3,695)	[887]	{443}	18,610	(3,722)	[893]	{447}	18,741	(3,748)	[900]	{450}
Pueblo	14,353	14,367	14,381	14,389	14,418	(2,884)	[692]	{346}	14,445	(2,889)	[693]	{347}	14,471	(2,894)	[695]	{347}
Weld	23,640	23,779	23,841	23,919	24,055	(4,811)	[1,155]	{577}	24,185	(4,837)	[1,161]	{580}	24,312	(4,862)	[1,167]	{583}

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.