

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

Date: 2/11/21

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 2/11/21 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.**

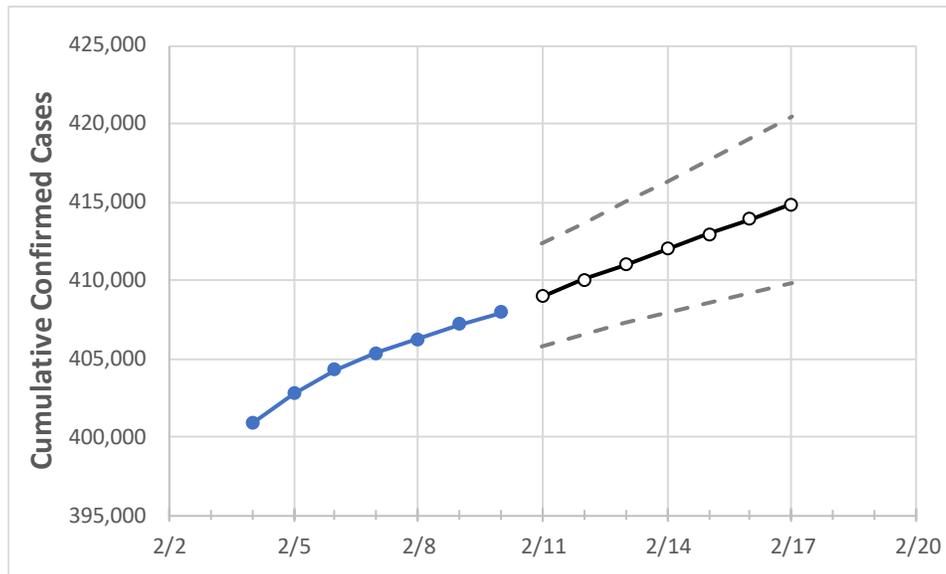
### IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Colorado	405,330	406,276	407,210	407,961	408,998	410,018	410,998	412,012	412,967	413,933	414,869

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Adams	46,481	46,547	46,609	46,649	46,730	46,809	46,886	46,960	47,031	47,099	47,164
Arapahoe	46,021	46,138	46,245	46,329	46,445	46,558	46,670	46,780	46,886	46,989	47,089
Boulder	17,646	17,706	17,756	17,777	17,830	17,880	17,928	17,975	18,023	18,070	18,115
Denver	56,677	56,844	56,997	57,068	57,193	57,314	57,434	57,553	57,669	57,782	57,892
Douglas	19,668	19,739	19,813	19,864	19,953	20,043	20,133	20,223	20,312	20,399	20,489
Eagle	4,598	4,621	4,635	4,648	4,669	4,690	4,712	4,732	4,752	4,773	4,792
El Paso	48,851	48,961	49,081	49,219	49,346	49,475	49,599	49,726	49,850	49,972	50,093
Gunnison	1,086	1,089	1,091	1,092	1,095	1,097	1,099	1,102	1,104	1,105	1,107
Jefferson	35,284	35,360	35,433	35,480	35,560	35,637	35,713	35,789	35,864	35,932	36,000
Larimer	18,564	18,622	18,669	18,719	18,778	18,835	18,892	18,948	19,003	19,055	19,108
Pueblo	14,441	14,449	14,452	14,451	14,463	14,474	14,485	14,495	14,505	14,515	14,524
Weld	24,185	24,247	24,310	24,380	24,450	24,518	24,587	24,656	24,724	24,791	24,857

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:											
	2/7	2/8	2/9	2/10	2/12			2/14			2/16					
Adams	46,481	46,547	46,609	46,649	46,809	(9,362)	[2,247]	{1,123}	46,960	(9,392)	[2,254]	{1,127}	47,099	(9,420)	[2,261]	{1,130}
Arapahoe	46,021	46,138	46,245	46,329	46,558	(9,312)	[2,235]	{1,117}	46,780	(9,356)	[2,245]	{1,123}	46,989	(9,398)	[2,255]	{1,128}
Boulder	17,646	17,706	17,756	17,777	17,880	(3,576)	[858]	{429}	17,975	(3,595)	[863]	{431}	18,070	(3,614)	[867]	{434}
Denver	56,677	56,844	56,997	57,068	57,314	(11,463)	[2,751]	{1,376}	57,553	(11,511)	[2,763]	{1,381}	57,782	(11,556)	[2,774]	{1,387}
Douglas	19,668	19,739	19,813	19,864	20,043	(4,009)	[962]	{481}	20,223	(4,045)	[971]	{485}	20,399	(4,080)	[979]	{490}
Eagle	4,598	4,621	4,635	4,648	4,690	(938)	[225]	{113}	4,732	(946)	[227]	{114}	4,773	(955)	[229]	{115}
El Paso	48,851	48,961	49,081	49,219	49,475	(9,895)	[2,375]	{1,187}	49,726	(9,945)	[2,387]	{1,193}	49,972	(9,994)	[2,399]	{1,199}
Gunnison	1,086	1,089	1,091	1,092	1,097	(219)	[53]	{26}	1,102	(220)	[53]	{26}	1,105	(221)	[53]	{27}
Jefferson	35,284	35,360	35,433	35,480	35,637	(7,127)	[1,711]	{855}	35,789	(7,158)	[1,718]	{859}	35,932	(7,186)	[1,725]	{862}
Larimer	18,564	18,622	18,669	18,719	18,835	(3,767)	[904]	{452}	18,948	(3,790)	[910]	{455}	19,055	(3,811)	[915]	{457}
Pueblo	14,441	14,449	14,452	14,451	14,474	(2,895)	[695]	{347}	14,495	(2,899)	[696]	{348}	14,515	(2,903)	[697]	{348}
Weld	24,185	24,247	24,310	24,380	24,518	(4,904)	[1,177]	{588}	24,656	(4,931)	[1,184]	{592}	24,791	(4,958)	[1,190]	{595}

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.