

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

Date: 3/3/21

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 3/3/21 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.**

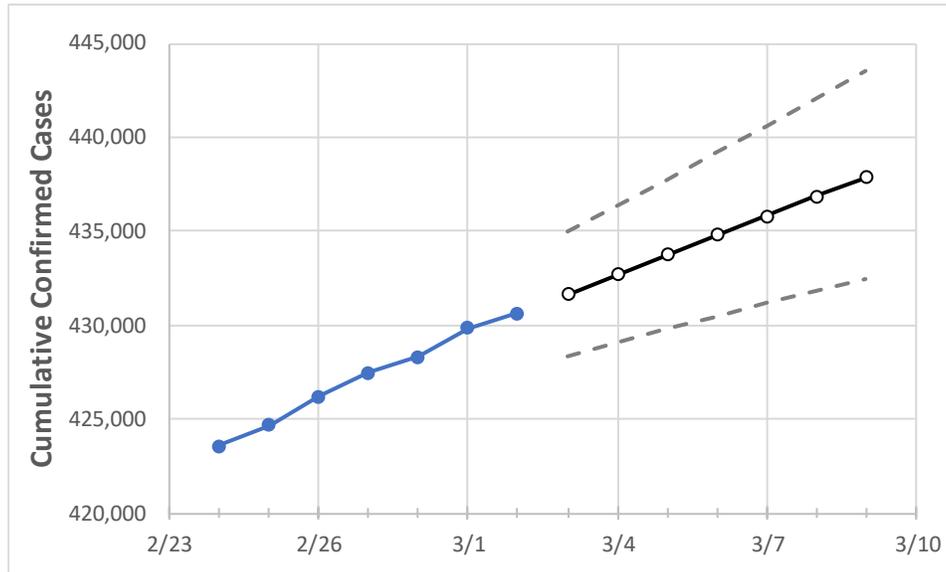
### IEM's Modeling Lead

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:					
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Colorado	427,462	428,303	429,839	430,615	431,655	432,712	433,744	434,783	435,797	436,842	437,862	

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:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Adams	48,340	48,413	48,560	48,635	48,742	48,848	48,957	49,065	49,174	49,281	49,391	
Arapahoe	48,384	48,463	48,640	48,715	48,830	48,943	49,056	49,165	49,280	49,396	49,511	
Boulder	18,762	18,799	18,888	18,910	18,957	19,002	19,047	19,092	19,137	19,179	19,221	
Denver	59,506	59,584	59,779	59,842	59,970	60,104	60,235	60,365	60,497	60,629	60,760	
Douglas	21,272	21,327	21,402	21,463	21,530	21,599	21,667	21,734	21,800	21,867	21,933	
Eagle	5,045	5,065	5,088	5,120	5,145	5,170	5,195	5,221	5,247	5,273	5,299	
El Paso	51,849	51,975	52,145	52,264	52,407	52,549	52,691	52,833	52,976	53,117	53,259	
Gunnison	1,202	1,203	1,205	1,207	1,209	1,210	1,212	1,214	1,215	1,216	1,218	
Jefferson	37,111	37,202	37,323	37,380	37,474	37,567	37,662	37,758	37,855	37,952	38,049	
Larimer	19,999	20,072	20,153	20,234	20,315	20,394	20,476	20,555	20,636	20,716	20,799	
Pueblo	14,995	15,007	15,046	15,058	15,071	15,085	15,096	15,109	15,120	15,130	15,141	
Weld	25,410	25,465	25,562	25,613	25,680	25,747	25,813	25,881	25,950	26,019	26,087	

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:											
	2/27	2/28	3/1	3/2	3/4			3/6			3/8					
Adams	48,340	48,413	48,560	48,635	48,848	(9,770)	[2,345]	{1,172}	49,065	(9,813)	[2,355]	{1,178}	49,281	(9,856)	[2,365]	{1,183}
Arapahoe	48,384	48,463	48,640	48,715	48,943	(9,789)	[2,349]	{1,175}	49,165	(9,833)	[2,360]	{1,180}	49,396	(9,879)	[2,371]	{1,185}
Boulder	18,762	18,799	18,888	18,910	19,002	(3,800)	[912]	{456}	19,092	(3,818)	[916]	{458}	19,179	(3,836)	[921]	{460}
Denver	59,506	59,584	59,779	59,842	60,104	(12,021)	[2,885]	{1,442}	60,365	(12,073)	[2,898]	{1,449}	60,629	(12,126)	[2,910]	{1,455}
Douglas	21,272	21,327	21,402	21,463	21,599	(4,320)	[1,037]	{518}	21,734	(4,347)	[1,043]	{522}	21,867	(4,373)	[1,050]	{525}
Eagle	5,045	5,065	5,088	5,120	5,170	(1,034)	[248]	{124}	5,221	(1,044)	[251]	{125}	5,273	(1,055)	[253]	{127}
El Paso	51,849	51,975	52,145	52,264	52,549	(10,510)	[2,522]	{1,261}	52,833	(10,567)	[2,536]	{1,268}	53,117	(10,623)	[2,550]	{1,275}
Gunnison	1,202	1,203	1,205	1,207	1,210	(242)	[58]	{29}	1,214	(243)	[58]	{29}	1,216	(243)	[58]	{29}
Jefferson	37,111	37,202	37,323	37,380	37,567	(7,513)	[1,803]	{902}	37,758	(7,552)	[1,812]	{906}	37,952	(7,590)	[1,822]	{911}
Larimer	19,999	20,072	20,153	20,234	20,394	(4,079)	[979]	{489}	20,555	(4,111)	[987]	{493}	20,716	(4,143)	[994]	{497}
Pueblo	14,995	15,007	15,046	15,058	15,085	(3,017)	[724]	{362}	15,109	(3,022)	[725]	{363}	15,130	(3,026)	[726]	{363}
Weld	25,410	25,465	25,562	25,613	25,747	(5,149)	[1,236]	{618}	25,881	(5,176)	[1,242]	{621}	26,019	(5,204)	[1,249]	{624}

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.