

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

Date: 6/3/21

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 6/3/21 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.**

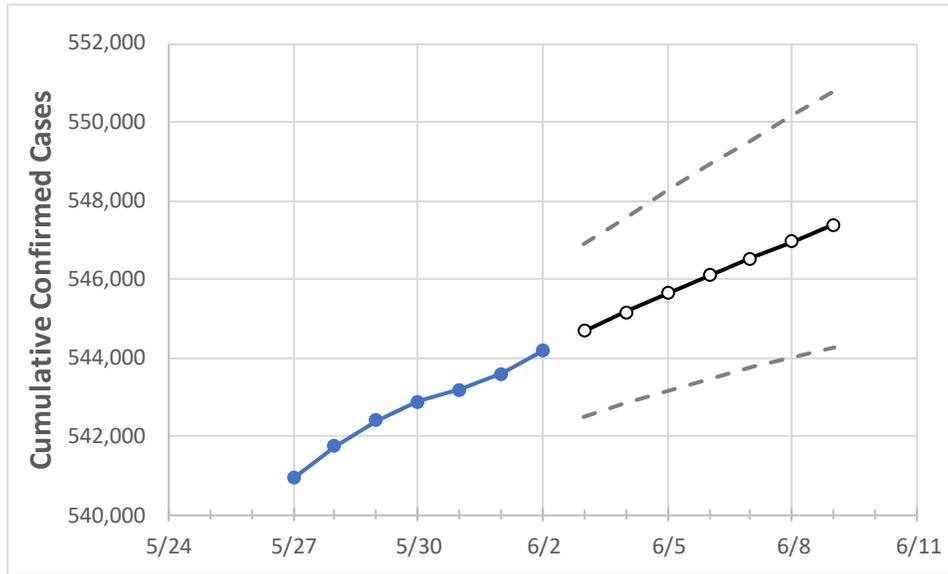
### IEM's Modeling Lead

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:							
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	
Colorado	542,889	543,174	543,581	544,157	544,677	545,168	545,640	546,094	546,529	546,967	547,376	

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:							
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	
Adams	59,741	59,771	59,799	59,820	59,857	59,892	59,927	59,959	59,988	60,015	60,040	
Arapahoe	61,448	61,469	61,516	61,562	61,614	61,664	61,712	61,755	61,797	61,838	61,876	
Boulder	23,667	23,675	23,684	23,692	23,705	23,718	23,729	23,741	23,753	23,764	23,775	
Denver	73,101	73,118	73,145	73,201	73,237	73,271	73,303	73,335	73,365	73,394	73,422	
Douglas	29,531	29,540	29,557	29,595	29,622	29,647	29,672	29,696	29,720	29,742	29,764	
Eagle	6,322	6,323	6,323	6,322	6,324	6,326	6,327	6,329	6,330	6,332	6,333	
El Paso	70,339	70,400	70,525	70,650	70,781	70,914	71,042	71,167	71,288	71,408	71,523	
Gunnison	1,351	1,352	1,351	1,351	1,352	1,353	1,354	1,355	1,357	1,358	1,359	
Jefferson	47,943	47,963	47,981	48,028	48,057	48,084	48,110	48,135	48,159	48,180	48,200	
Larimer	26,965	26,978	26,997	27,034	27,053	27,072	27,089	27,107	27,123	27,139	27,154	
Pueblo	19,088	19,094	19,101	19,118	19,133	19,147	19,160	19,173	19,185	19,196	19,208	
Weld	32,551	32,578	32,604	32,645	32,678	32,710	32,740	32,770	32,799	32,826	32,853	

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:								
	5/30	5/31	6/1	6/2	6/4		6/6		6/8				
Adams	59,741	59,771	59,799	59,820	59,892 (11,978)	[2,875]	{1,437}	59,959 (11,992)	[2,878]	{1,439}	60,015 (12,003)	[2,881]	{1,440}
Arapahoe	61,448	61,469	61,516	61,562	61,664 (12,333)	[2,960]	{1,480}	61,755 (12,351)	[2,964]	{1,482}	61,838 (12,368)	[2,968]	{1,484}
Boulder	23,667	23,675	23,684	23,692	23,718 (4,744)	[1,138]	{569}	23,741 (4,748)	[1,140]	{570}	23,764 (4,753)	[1,141]	{570}
Denver	73,101	73,118	73,145	73,201	73,271 (14,654)	[3,517]	{1,759}	73,335 (14,667)	[3,520]	{1,760}	73,394 (14,679)	[3,523]	{1,761}
Douglas	29,531	29,540	29,557	29,595	29,647 (5,929)	[1,423]	{712}	29,696 (5,939)	[1,425]	{713}	29,742 (5,948)	[1,428]	{714}
Eagle	6,322	6,323	6,323	6,322	6,326 (1,265)	[304]	{152}	6,329 (1,266)	[304]	{152}	6,332 (1,266)	[304]	{152}
El Paso	70,339	70,400	70,525	70,650	70,914 (14,183)	[3,404]	{1,702}	71,167 (14,233)	[3,416]	{1,708}	71,408 (14,282)	[3,428]	{1,714}
Gunnison	1,351	1,352	1,351	1,351	1,353 (271)	[65]	{32}	1,355 (271)	[65]	{33}	1,358 (272)	[65]	{33}
Jefferson	47,943	47,963	47,981	48,028	48,084 (9,617)	[2,308]	{1,154}	48,135 (9,627)	[2,310]	{1,155}	48,180 (9,636)	[2,313]	{1,156}
Larimer	26,965	26,978	26,997	27,034	27,072 (5,414)	[1,299]	{650}	27,107 (5,421)	[1,301]	{651}	27,139 (5,428)	[1,303]	{651}
Pueblo	19,088	19,094	19,101	19,118	19,147 (3,829)	[919]	{460}	19,173 (3,835)	[920]	{460}	19,196 (3,839)	[921]	{461}
Weld	32,551	32,578	32,604	32,645	32,710 (6,542)	[1,570]	{785}	32,770 (6,554)	[1,573]	{786}	32,826 (6,565)	[1,576]	{788}

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.