

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 5/11/21**

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 5/11/21 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.

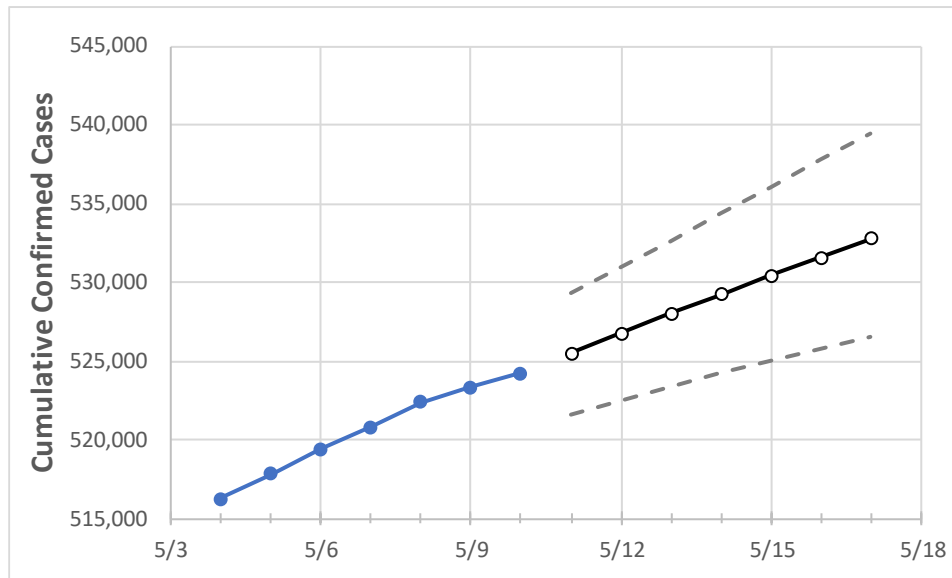
IEM's Modeling Lead

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Colorado	520,816	522,382	523,309	524,190	525,460	526,747	527,993	529,227	530,398	531,589	532,754

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Adams	57,286	57,492	57,574	57,676	57,828	57,980	58,127	58,269	58,420	58,563	58,705
Arapahoe	58,727	58,925	59,043	59,127	59,271	59,409	59,544	59,677	59,808	59,937	60,064
Boulder	23,147	23,206	23,229	23,255	23,289	23,323	23,356	23,387	23,419	23,449	23,476
Denver	71,357	71,512	71,613	71,672	71,793	71,913	72,030	72,138	72,245	72,348	72,451
Douglas	28,387	28,477	28,523	28,581	28,654	28,724	28,790	28,855	28,920	28,980	29,035
Eagle	6,269	6,269	6,268	6,268	6,275	6,281	6,288	6,294	6,300	6,306	6,312
El Paso	65,666	65,930	66,144	66,374	66,630	66,889	67,148	67,405	67,666	67,929	68,194
Gunnison	1,329	1,331	1,332	1,333	1,334	1,335	1,336	1,337	1,338	1,339	1,340
Jefferson	46,003	46,181	46,262	46,336	46,455	46,573	46,690	46,804	46,916	47,028	47,136
Larimer	25,964	26,030	26,078	26,123	26,186	26,249	26,310	26,370	26,428	26,485	26,541
Pueblo	18,397	18,457	18,498	18,534	18,607	18,677	18,748	18,818	18,890	18,961	19,028
Weld	31,117	31,199	31,272	31,336	31,415	31,494	31,572	31,648	31,726	31,800	31,873

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:											
	5/7	5/8	5/9	5/10	5/12				5/14				5/16			
Adams	57,286	57,492	57,574	57,676	57,980	(11,596)	[2,783]	{1,392}	58,269	(11,654)	[2,797]	{1,398}	58,563	(11,713)	[2,811]	{1,406}
Arapahoe	58,727	58,925	59,043	59,127	59,409	(11,882)	[2,852]	{1,426}	59,677	(11,935)	[2,864]	{1,432}	59,937	(11,987)	[2,877]	{1,438}
Boulder	23,147	23,206	23,229	23,255	23,323	(4,665)	[1,119]	{560}	23,387	(4,677)	[1,123]	{561}	23,449	(4,690)	[1,126]	{563}
Denver	71,357	71,512	71,613	71,672	71,913	(14,383)	[3,452]	{1,726}	72,138	(14,428)	[3,463]	{1,731}	72,348	(14,470)	[3,473]	{1,736}
Douglas	28,387	28,477	28,523	28,581	28,724	(5,745)	[1,379]	{689}	28,855	(5,771)	[1,385]	{693}	28,980	(5,796)	[1,391]	{696}
Eagle	6,269	6,269	6,268	6,268	6,281	(1,256)	[301]	{151}	6,294	(1,259)	[302]	{151}	6,306	(1,261)	[303]	{151}
El Paso	65,666	65,930	66,144	66,374	66,889	(13,378)	[3,211]	{1,605}	67,405	(13,481)	[3,235]	{1,618}	67,929	(13,586)	[3,261]	{1,630}
Gunnison	1,329	1,331	1,332	1,333	1,335	(267)	[64]	{32}	1,337	(267)	[64]	{32}	1,339	(268)	[64]	{32}
Jefferson	46,003	46,181	46,262	46,336	46,573	(9,315)	[2,235]	{1,118}	46,804	(9,361)	[2,247]	{1,123}	47,028	(9,406)	[2,257]	{1,129}
Larimer	25,964	26,030	26,078	26,123	26,249	(5,250)	[1,260]	{630}	26,370	(5,274)	[1,266]	{633}	26,485	(5,297)	[1,271]	{636}
Pueblo	18,397	18,457	18,498	18,534	18,677	(3,735)	[896]	{448}	18,818	(3,764)	[903]	{452}	18,961	(3,792)	[910]	{455}
Weld	31,117	31,199	31,272	31,336	31,494	(6,299)	[1,512]	{756}	31,648	(6,330)	[1,519]	{760}	31,800	(6,360)	[1,526]	{763}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.