

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

Date: 4/9/21

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 4/9/21 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.**

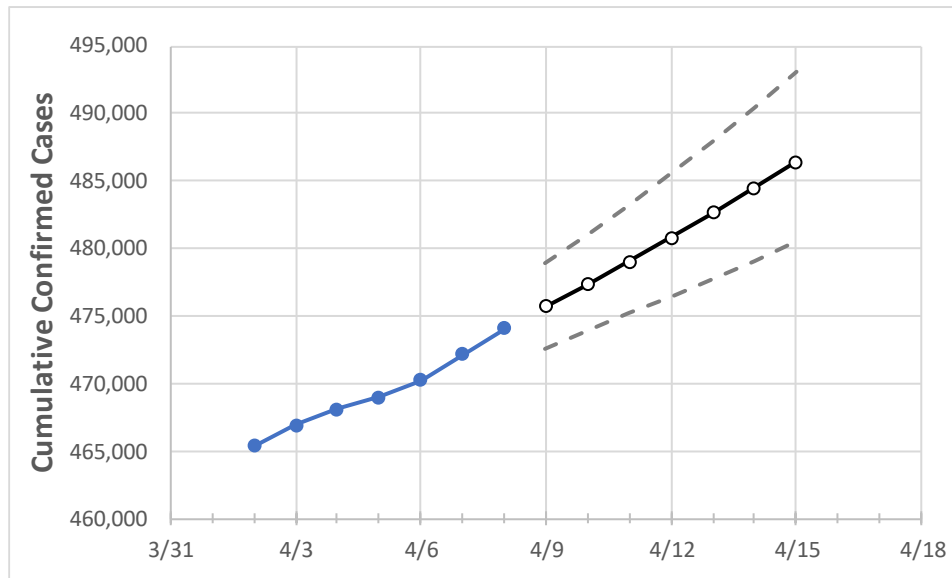
### IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Colorado	468,988	470,254	472,168	474,053	475,698	477,357	479,046	480,832	482,625	484,483	486,383

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Adams	51,997	52,098	52,241	52,421	52,561	52,701	52,852	53,004	53,159	53,315	53,471
Arapahoe	52,671	52,789	53,007	53,228	53,399	53,575	53,755	53,949	54,148	54,349	54,554
Boulder	21,018	21,071	21,173	21,272	21,368	21,467	21,568	21,671	21,778	21,888	21,999
Denver	65,148	65,395	65,737	65,934	66,161	66,393	66,631	66,873	67,124	67,372	67,629
Douglas	24,365	24,467	24,611	24,774	24,912	25,060	25,210	25,369	25,535	25,704	25,881
Eagle	5,809	5,842	5,860	5,889	5,908	5,927	5,945	5,964	5,982	6,001	6,019
El Paso	57,731	57,917	58,206	58,473	58,734	58,992	59,257	59,530	59,817	60,116	60,418
Gunnison	1,263	1,263	1,264	1,265	1,267	1,269	1,271	1,273	1,275	1,277	1,279
Jefferson	41,024	41,129	41,296	41,488	41,631	41,778	41,927	42,077	42,235	42,393	42,558
Larimer	22,805	22,892	23,050	23,158	23,278	23,401	23,531	23,659	23,798	23,936	24,076
Pueblo	16,075	16,093	16,139	16,216	16,273	16,332	16,394	16,457	16,526	16,597	16,669
Weld	27,875	27,948	28,075	28,196	28,297	28,400	28,508	28,619	28,733	28,851	28,972

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:											
	4/5	4/6	4/7	4/8	4/10				4/12				4/14			
Adams	51,997	52,098	52,241	52,421	52,701	(10,540)	[2,530]	{1,265}	53,004	(10,601)	[2,544]	{1,272}	53,315	(10,663)	[2,559]	{1,280}
Arapahoe	52,671	52,789	53,007	53,228	53,575	(10,715)	[2,572]	{1,286}	53,949	(10,790)	[2,590]	{1,295}	54,349	(10,870)	[2,609]	{1,304}
Boulder	21,018	21,071	21,173	21,272	21,467	(4,293)	[1,030]	{515}	21,671	(4,334)	[1,040]	{520}	21,888	(4,378)	[1,051]	{525}
Denver	65,148	65,395	65,737	65,934	66,393	(13,279)	[3,187]	{1,593}	66,873	(13,375)	[3,210]	{1,605}	67,372	(13,474)	[3,234]	{1,617}
Douglas	24,365	24,467	24,611	24,774	25,060	(5,012)	[1,203]	{601}	25,369	(5,074)	[1,218]	{609}	25,704	(5,141)	[1,234]	{617}
Eagle	5,809	5,842	5,860	5,889	5,927	(1,185)	[284]	{142}	5,964	(1,193)	[286]	{143}	6,001	(1,200)	[288]	{144}
El Paso	57,731	57,917	58,206	58,473	58,992	(11,798)	[2,832]	{1,416}	59,530	(11,906)	[2,857]	{1,429}	60,116	(12,023)	[2,886]	{1,443}
Gunnison	1,263	1,263	1,264	1,265	1,269	(254)	[61]	{30}	1,273	(255)	[61]	{31}	1,277	(255)	[61]	{31}
Jefferson	41,024	41,129	41,296	41,488	41,778	(8,356)	[2,005]	{1,003}	42,077	(8,415)	[2,020]	{1,010}	42,393	(8,479)	[2,035]	{1,017}
Larimer	22,805	22,892	23,050	23,158	23,401	(4,680)	[1,123]	{562}	23,659	(4,732)	[1,136]	{568}	23,936	(4,787)	[1,149]	{574}
Pueblo	16,075	16,093	16,139	16,216	16,332	(3,266)	[784]	{392}	16,457	(3,291)	[790]	{395}	16,597	(3,319)	[797]	{398}
Weld	27,875	27,948	28,075	28,196	28,400	(5,680)	[1,363]	{682}	28,619	(5,724)	[1,374]	{687}	28,851	(5,770)	[1,385]	{692}

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.