

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

Date: 11/10/21

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 11/10/21 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.**

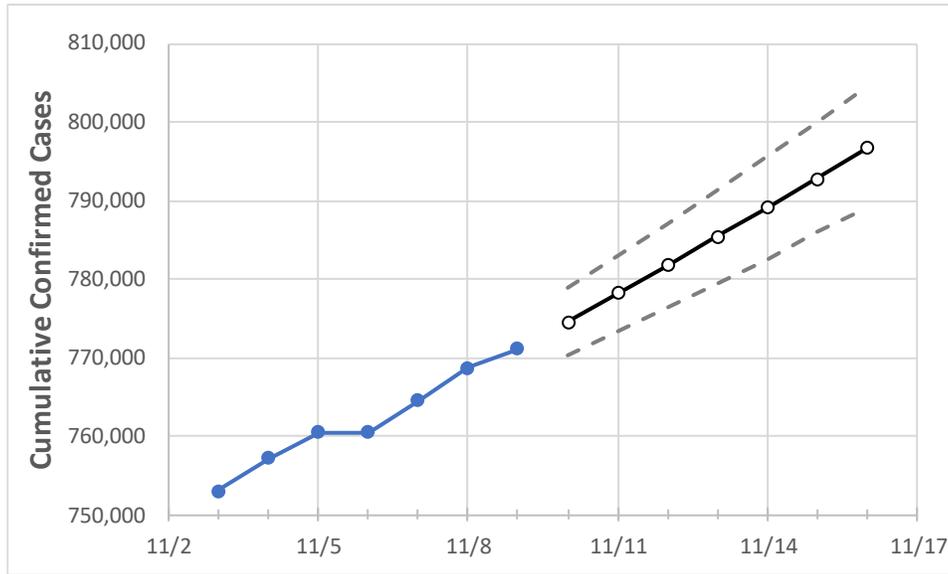
### IEM's Modeling Lead

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:					
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	
Colorado	760,453	764,550	768,646	771,061	774,574	778,167	781,709	785,369	789,046	792,805	796,645	

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:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	
Adams	78,206	78,452	78,697	78,874	79,137	79,397	79,650	79,909	80,176	80,453	80,715	
Arapahoe	82,270	82,538	82,805	83,061	83,345	83,634	83,922	84,216	84,509	84,808	85,109	
Boulder	31,975	32,089	32,203	32,325	32,460	32,599	32,738	32,881	33,027	33,176	33,329	
Denver	94,492	94,796	95,099	95,406	95,734	96,068	96,401	96,745	97,095	97,440	97,804	
Douglas	41,935	42,092	42,249	42,360	42,521	42,681	42,844	43,007	43,171	43,343	43,513	
Eagle	8,640	8,666	8,692	8,765	8,799	8,835	8,871	8,908	8,947	8,985	9,027	
El Paso	105,724	106,106	106,489	106,790	107,237	107,672	108,112	108,558	109,001	109,467	109,912	
Gunnison	1,866	1,869	1,872	1,879	1,883	1,887	1,891	1,895	1,899	1,904	1,908	
Jefferson	66,078	66,354	66,630	66,827	67,122	67,425	67,726	68,028	68,342	68,662	68,980	
Larimer	41,296	41,446	41,595	41,749	41,966	42,171	42,381	42,602	42,813	43,033	43,252	
Pueblo	26,852	26,968	27,084	27,212	27,371	27,532	27,691	27,857	28,025	28,189	28,361	
Weld	48,708	48,901	49,095	49,219	49,419	49,618	49,817	50,019	50,216	50,418	50,625	

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:											
	11/6	11/7	11/8	11/9	11/11		11/13		11/15		11/17		11/19			
Adams	78,206	78,452	78,697	78,874	79,397	(15,879)	[3,811]	{1,906}	79,909	(15,982)	[3,836]	{1,918}	80,453	(16,091)	[3,862]	{1,931}
Arapahoe	82,270	82,538	82,805	83,061	83,634	(16,727)	[4,014]	{2,007}	84,216	(16,843)	[4,042]	{2,021}	84,808	(16,962)	[4,071]	{2,035}
Boulder	31,975	32,089	32,203	32,325	32,599	(6,520)	[1,565]	{782}	32,881	(6,576)	[1,578]	{789}	33,176	(6,635)	[1,592]	{796}
Denver	94,492	94,796	95,099	95,406	96,068	(19,214)	[4,611]	{2,306}	96,745	(19,349)	[4,644]	{2,322}	97,440	(19,488)	[4,677]	{2,339}
Douglas	41,935	42,092	42,249	42,360	42,681	(8,536)	[2,049]	{1,024}	43,007	(8,601)	[2,064]	{1,032}	43,343	(8,669)	[2,080]	{1,040}
Eagle	8,640	8,666	8,692	8,765	8,835	(1,767)	[424]	{212}	8,908	(1,782)	[428]	{214}	8,985	(1,797)	[431]	{216}
El Paso	105,724	106,106	106,489	106,790	107,672	(21,534)	[5,168]	{2,584}	108,558	(21,712)	[5,211]	{2,605}	109,467	(21,893)	[5,254]	{2,627}
Gunnison	1,866	1,869	1,872	1,879	1,887	(377)	[91]	{45}	1,895	(379)	[91]	{45}	1,904	(381)	[91]	{46}
Jefferson	66,078	66,354	66,630	66,827	67,425	(13,485)	[3,236]	{1,618}	68,028	(13,606)	[3,265]	{1,633}	68,662	(13,732)	[3,296]	{1,648}
Larimer	41,296	41,446	41,595	41,749	42,171	(8,434)	[2,024]	{1,012}	42,602	(8,520)	[2,045]	{1,022}	43,033	(8,607)	[2,066]	{1,033}
Pueblo	26,852	26,968	27,084	27,212	27,532	(5,506)	[1,322]	{661}	27,857	(5,571)	[1,337]	{669}	28,189	(5,638)	[1,353]	{677}
Weld	48,708	48,901	49,095	49,219	49,618	(9,924)	[2,382]	{1,191}	50,019	(10,004)	[2,401]	{1,200}	50,418	(10,084)	[2,420]	{1,210}

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.