

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 1/12/21**

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 1/12/21 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.**

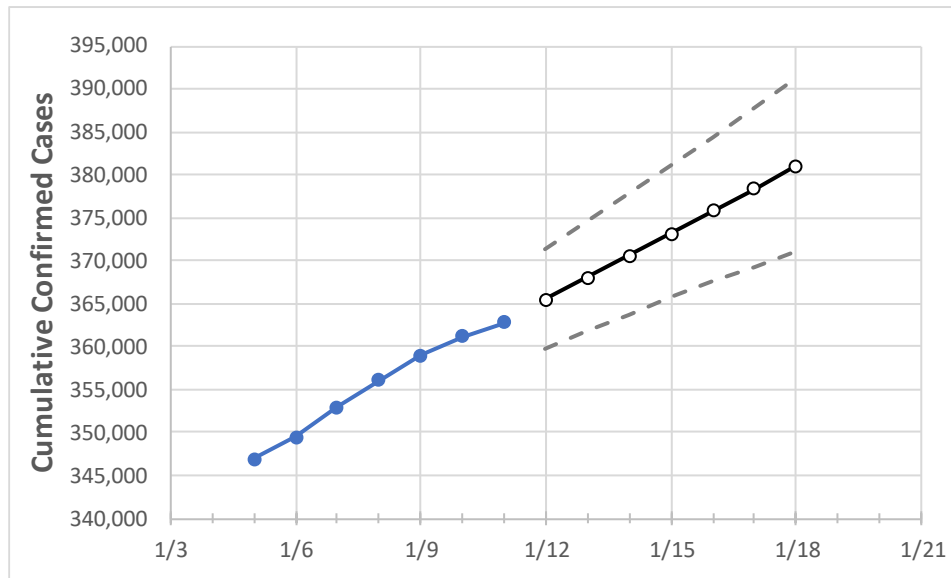
**IEM's Modeling Lead**

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Colorado	356,110	358,947	361,148	362,825	365,452	368,014	370,579	373,168	375,775	378,415	381,078

*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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Adams	42,174	42,490	42,730	42,903	43,171	43,441	43,708	43,977	44,247	44,508	44,771
Arapahoe	40,502	40,831	41,092	41,314	41,614	41,916	42,216	42,520	42,825	43,137	43,454
Boulder	15,516	15,644	15,741	15,792	15,898	16,003	16,110	16,214	16,322	16,426	16,535
Denver	50,957	51,286	51,608	51,825	52,210	52,601	52,998	53,410	53,841	54,261	54,667
Douglas	16,779	16,905	17,047	17,134	17,269	17,408	17,546	17,686	17,825	17,968	18,110
Eagle	3,635	3,665	3,692	3,704	3,734	3,766	3,798	3,830	3,861	3,893	3,924
El Paso	43,540	43,957	44,205	44,372	44,643	44,912	45,185	45,453	45,712	45,966	46,230
Gunnison	752	771	787	792	799	807	816	823	832	840	849
Jefferson	31,305	31,516	31,685	31,837	32,023	32,214	32,401	32,586	32,777	32,962	33,145
Larimer	16,029	16,146	16,204	16,275	16,380	16,484	16,586	16,689	16,792	16,897	16,998
Pueblo	13,679	13,763	13,802	13,843	13,880	13,916	13,950	13,984	14,017	14,046	14,076
Weld	21,360	21,471	21,620	21,735	21,899	22,067	22,235	22,405	22,574	22,744	22,919

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:											
	1/8	1/9	1/10	1/11	1/13				1/15				1/17			
Adams	42,174	42,490	42,730	42,903	43,441	(8,688)	[2,085]	{1,043}	43,977	(8,795)	[2,111]	{1,055}	44,508	(8,902)	[2,136]	{1,068}
Arapahoe	40,502	40,831	41,092	41,314	41,916	(8,383)	[2,012]	{1,006}	42,520	(8,504)	[2,041]	{1,020}	43,137	(8,627)	[2,071]	{1,035}
Boulder	15,516	15,644	15,741	15,792	16,003	(3,201)	[768]	{384}	16,214	(3,243)	[778]	{389}	16,426	(3,285)	[788]	{394}
Denver	50,957	51,286	51,608	51,825	52,601	(10,520)	[2,525]	{1,262}	53,410	(10,682)	[2,564]	{1,282}	54,261	(10,852)	[2,605]	{1,302}
Douglas	16,779	16,905	17,047	17,134	17,408	(3,482)	[836]	{418}	17,686	(3,537)	[849]	{424}	17,968	(3,594)	[862]	{431}
Eagle	3,635	3,665	3,692	3,704	3,766	(753)	[181]	{90}	3,830	(766)	[184]	{92}	3,893	(779)	[187]	{93}
El Paso	43,540	43,957	44,205	44,372	44,912	(8,982)	[2,156]	{1,078}	45,453	(9,091)	[2,182]	{1,091}	45,966	(9,193)	[2,206]	{1,103}
Gunnison	752	771	787	792	807	(161)	[39]	{19}	823	(165)	[40]	{20}	840	(168)	[40]	{20}
Jefferson	31,305	31,516	31,685	31,837	32,214	(6,443)	[1,546]	{773}	32,586	(6,517)	[1,564]	{782}	32,962	(6,592)	[1,582]	{791}
Larimer	16,029	16,146	16,204	16,275	16,484	(3,297)	[791]	{396}	16,689	(3,338)	[801]	{401}	16,897	(3,379)	[811]	{406}
Pueblo	13,679	13,763	13,802	13,843	13,916	(2,783)	[668]	{334}	13,984	(2,797)	[671]	{336}	14,046	(2,809)	[674]	{337}
Weld	21,360	21,471	21,620	21,735	22,067	(4,413)	[1,059]	{530}	22,405	(4,481)	[1,075]	{538}	22,744	(4,549)	[1,092]	{546}

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.