

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/22/20**

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 10/22/20 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.

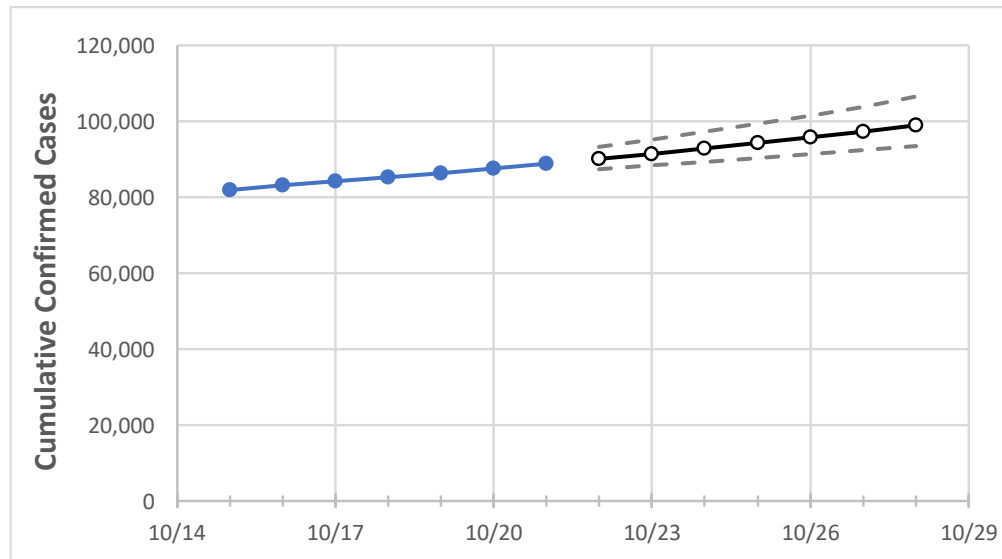
IEM's Modeling Lead

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:					
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Colorado	85,279	86,351	87,559	88,826	90,118	91,462	92,861	94,318	95,834	97,412	99,055

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 20%, and are often within 10%, of actual confirmed cases.

Colorado Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Adams	11,831	12,020	12,200	12,408	12,616	12,833	13,058	13,292	13,535	13,788	14,051
Arapahoe	11,142	11,252	11,378	11,529	11,680	11,838	12,002	12,173	12,351	12,536	12,728
Boulder	4,996	5,042	5,094	5,141	5,175	5,210	5,245	5,281	5,316	5,353	5,390
Denver	15,947	16,117	16,240	16,386	16,572	16,762	16,957	17,156	17,360	17,569	17,783
Douglas	3,296	3,354	3,397	3,434	3,481	3,529	3,578	3,629	3,680	3,733	3,788
Eagle	1,342	1,344	1,353	1,366	1,371	1,376	1,382	1,387	1,393	1,399	1,405
El Paso	8,459	8,582	8,764	9,003	9,178	9,367	9,568	9,785	10,016	10,265	10,532
Gunnison	297	299	301	304	305	307	309	311	313	315	318
Jefferson	7,168	7,252	7,404	7,492	7,604	7,720	7,840	7,964	8,093	8,227	8,366
Larimer	3,500	3,547	3,600	3,640	3,702	3,765	3,830	3,898	3,967	4,038	4,111
Pueblo	1,582	1,613	1,631	1,697	1,741	1,788	1,837	1,889	1,944	2,003	2,065
Weld	5,392	5,442	5,507	5,563	5,606	5,651	5,697	5,744	5,792	5,842	5,894

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:											
	10/18	10/19	10/20	10/21	10/23				10/25				10/27			
Adams	11,831	12,020	12,200	12,408	12,833	(2,567)	[616]	{308}	13,292	(2,658)	[638]	{319}	13,788	(2,758)	[662]	{331}
Arapahoe	11,142	11,252	11,378	11,529	11,838	(2,368)	[568]	{284}	12,173	(2,435)	[584]	{292}	12,536	(2,507)	[602]	{301}
Boulder	4,996	5,042	5,094	5,141	5,210	(1,042)	[250]	{125}	5,281	(1,056)	[253]	{127}	5,353	(1,071)	[257]	{128}
Denver	15,947	16,117	16,240	16,386	16,762	(3,352)	[805]	{402}	17,156	(3,431)	[824]	{412}	17,569	(3,514)	[843]	{422}
Douglas	3,296	3,354	3,397	3,434	3,529	(706)	[169]	{85}	3,629	(726)	[174]	{87}	3,733	(747)	[179]	{90}
Eagle	1,342	1,344	1,353	1,366	1,376	(275)	[66]	{33}	1,387	(277)	[67]	{33}	1,399	(280)	[67]	{34}
El Paso	8,459	8,582	8,764	9,003	9,367	(1,873)	[450]	{225}	9,785	(1,957)	[470]	{235}	10,265	(2,053)	[493]	{246}
Gunnison	297	299	301	304	307	(61)	[15]	{7}	311	(62)	[15]	{7}	315	(63)	[15]	{8}
Jefferson	7,168	7,252	7,404	7,492	7,720	(1,544)	[371]	{185}	7,964	(1,593)	[382]	{191}	8,227	(1,645)	[395]	{197}
Larimer	3,500	3,547	3,600	3,640	3,765	(753)	[181]	{90}	3,898	(780)	[187]	{94}	4,038	(808)	[194]	{97}
Pueblo	1,582	1,613	1,631	1,697	1,788	(358)	[86]	{43}	1,889	(378)	[91]	{45}	2,003	(401)	[96]	{48}
Weld	5,392	5,442	5,507	5,563	5,651	(1,130)	[271]	{136}	5,744	(1,149)	[276]	{138}	5,842	(1,168)	[280]	{140}

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.