

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

Date: 6/17/21

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 6/17/21 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.

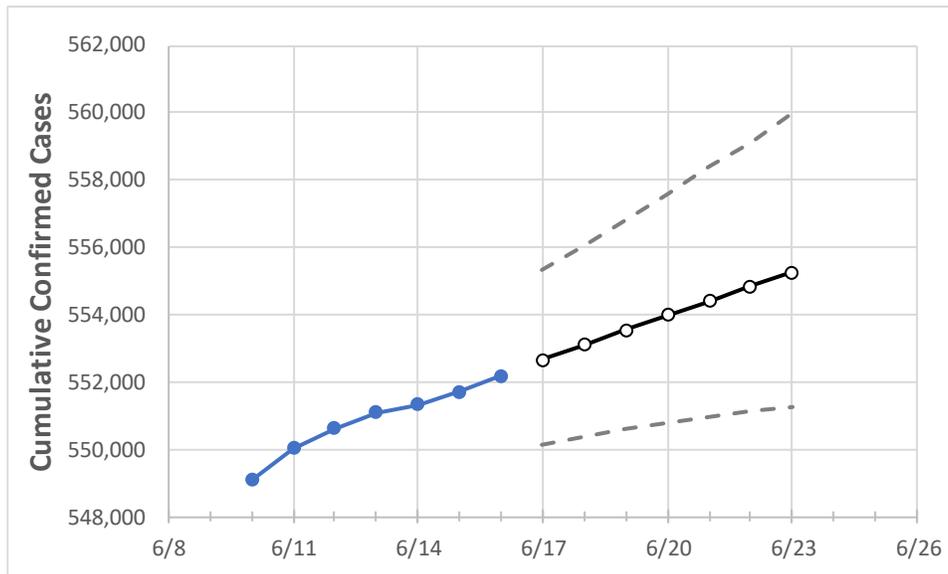
IEM's Modeling Lead

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:					
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Colorado	551,091	551,328	551,719	552,183	552,658	553,113	553,557	553,983	554,414	554,836	555,268

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:					
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Adams	60,369	60,397	60,442	60,478	60,518	60,558	60,596	60,635	60,671	60,709	60,745
Arapahoe	62,182	62,199	62,264	62,297	62,339	62,381	62,423	62,461	62,500	62,537	62,574
Boulder	23,855	23,861	23,870	23,880	23,891	23,901	23,911	23,921	23,931	23,941	23,949
Denver	73,876	73,893	73,927	73,966	74,018	74,069	74,120	74,173	74,224	74,273	74,324
Douglas	30,052	30,060	30,089	30,111	30,140	30,168	30,194	30,222	30,249	30,276	30,302
Eagle	6,341	6,341	6,340	6,339	6,341	6,343	6,345	6,346	6,348	6,350	6,352
El Paso	72,095	72,148	72,254	72,368	72,461	72,557	72,648	72,739	72,827	72,911	72,993
Gunnison	1,371	1,370	1,372	1,374	1,376	1,378	1,379	1,381	1,383	1,385	1,387
Jefferson	48,497	48,510	48,520	48,546	48,575	48,604	48,633	48,662	48,690	48,716	48,743
Larimer	27,338	27,356	27,390	27,416	27,440	27,464	27,489	27,512	27,536	27,559	27,583
Pueblo	19,406	19,409	19,387	19,396	19,419	19,442	19,465	19,488	19,511	19,534	19,558
Weld	33,063	33,084	33,107	33,139	33,165	33,191	33,216	33,240	33,263	33,286	33,309

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:											
	6/13	6/14	6/15	6/16	6/18			6/20			6/22					
Adams	60,369	60,397	60,442	60,478	60,558	(12,112)	[2,907]	{1,453}	60,635	(12,127)	[2,910]	{1,455}	60,709	(12,142)	[2,914]	{1,457}
Arapahoe	62,182	62,199	62,264	62,297	62,381	(12,476)	[2,994]	{1,497}	62,461	(12,492)	[2,998]	{1,499}	62,537	(12,507)	[3,002]	{1,501}
Boulder	23,855	23,861	23,870	23,880	23,901	(4,780)	[1,147]	{574}	23,921	(4,784)	[1,148]	{574}	23,941	(4,788)	[1,149]	{575}
Denver	73,876	73,893	73,927	73,966	74,069	(14,814)	[3,555]	{1,778}	74,173	(14,835)	[3,560]	{1,780}	74,273	(14,855)	[3,565]	{1,783}
Douglas	30,052	30,060	30,089	30,111	30,168	(6,034)	[1,448]	{724}	30,222	(6,044)	[1,451]	{725}	30,276	(6,055)	[1,453]	{727}
Eagle	6,341	6,341	6,340	6,339	6,343	(1,269)	[304]	{152}	6,346	(1,269)	[305]	{152}	6,350	(1,270)	[305]	{152}
El Paso	72,095	72,148	72,254	72,368	72,557	(14,511)	[3,483]	{1,741}	72,739	(14,548)	[3,491]	{1,746}	72,911	(14,582)	[3,500]	{1,750}
Gunnison	1,371	1,370	1,372	1,374	1,378	(276)	[66]	{33}	1,381	(276)	[66]	{33}	1,385	(277)	[66]	{33}
Jefferson	48,497	48,510	48,520	48,546	48,604	(9,721)	[2,333]	{1,167}	48,662	(9,732)	[2,336]	{1,168}	48,716	(9,743)	[2,338]	{1,169}
Larimer	27,338	27,356	27,390	27,416	27,464	(5,493)	[1,318]	{659}	27,512	(5,502)	[1,321]	{660}	27,559	(5,512)	[1,323]	{661}
Pueblo	19,406	19,409	19,387	19,396	19,442	(3,888)	[933]	{467}	19,488	(3,898)	[935]	{468}	19,534	(3,907)	[938]	{469}
Weld	33,063	33,084	33,107	33,139	33,191	(6,638)	[1,593]	{797}	33,240	(6,648)	[1,596]	{798}	33,286	(6,657)	[1,598]	{799}

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.