

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

Date: 8/9/21

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 8/9/21 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.

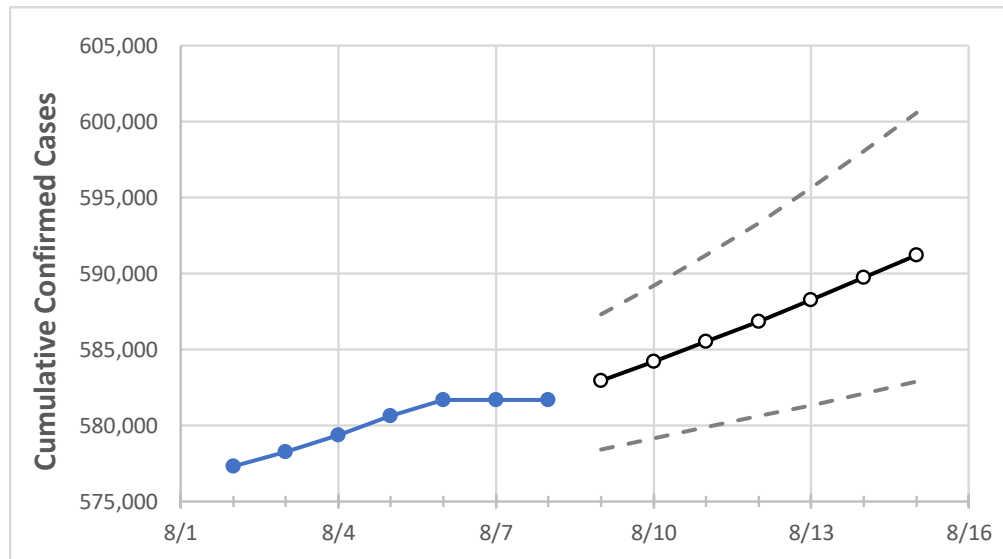
IEM's Modeling Lead

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:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
Colorado	580,610	581,692	581,692	581,692	582,933	584,210	585,500	586,834	588,238	589,719	591,215

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:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
Adams	62,915	63,012	63,012	63,012	63,120	63,233	63,348	63,472	63,594	63,726	63,856
Arapahoe	65,021	65,121	65,121	65,121	65,256	65,396	65,542	65,695	65,853	66,021	66,194
Boulder	24,959	24,995	24,995	24,995	25,049	25,106	25,165	25,226	25,290	25,355	25,425
Denver	76,835	76,952	76,952	76,952	77,132	77,324	77,527	77,741	77,971	78,206	78,458
Douglas	31,719	31,780	31,780	31,780	31,856	31,937	32,023	32,112	32,208	32,306	32,411
Eagle	6,599	6,622	6,622	6,622	6,642	6,663	6,686	6,711	6,737	6,765	6,795
El Paso	77,258	77,490	77,490	77,490	77,720	77,960	78,213	78,475	78,744	79,026	79,317
Gunnison	1,438	1,441	1,441	1,441	1,444	1,447	1,450	1,454	1,457	1,461	1,465
Jefferson	50,690	50,763	50,763	50,763	50,874	50,988	51,108	51,235	51,363	51,500	51,643
Larimer	29,118	29,198	29,198	29,198	29,279	29,360	29,446	29,538	29,632	29,731	29,829
Pueblo	20,022	20,064	20,064	20,064	20,090	20,117	20,145	20,174	20,205	20,236	20,269
Weld	34,782	34,841	34,841	34,841	34,915	34,994	35,074	35,158	35,245	35,336	35,428

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:											
	8/5	8/6	8/7	8/8	8/10				8/12				8/14			
Adams	62,915	63,012	63,012	63,012	63,233	(12,647)	[3,035]	{1,518}	63,472	(12,694)	[3,047]	{1,523}	63,726	(12,745)	[3,059]	{1,529}
Arapahoe	65,021	65,121	65,121	65,121	65,396	(13,079)	[3,139]	{1,569}	65,695	(13,139)	[3,153]	{1,577}	66,021	(13,204)	[3,169]	{1,585}
Boulder	24,959	24,995	24,995	24,995	25,106	(5,021)	[1,205]	{603}	25,226	(5,045)	[1,211]	{605}	25,355	(5,071)	[1,217]	{609}
Denver	76,835	76,952	76,952	76,952	77,324	(15,465)	[3,712]	{1,856}	77,741	(15,548)	[3,732]	{1,866}	78,206	(15,641)	[3,754]	{1,877}
Douglas	31,719	31,780	31,780	31,780	31,937	(6,387)	[1,533]	{766}	32,112	(6,422)	[1,541]	{771}	32,306	(6,461)	[1,551]	{775}
Eagle	6,599	6,622	6,622	6,622	6,663	(1,333)	[320]	{160}	6,711	(1,342)	[322]	{161}	6,765	(1,353)	[325]	{162}
El Paso	77,258	77,490	77,490	77,490	77,960	(15,592)	[3,742]	{1,871}	78,475	(15,695)	[3,767]	{1,883}	79,026	(15,805)	[3,793]	{1,897}
Gunnison	1,438	1,441	1,441	1,441	1,447	(289)	[69]	{35}	1,454	(291)	[70]	{35}	1,461	(292)	[70]	{35}
Jefferson	50,690	50,763	50,763	50,763	50,988	(10,198)	[2,447]	{1,224}	51,235	(10,247)	[2,459]	{1,230}	51,500	(10,300)	[2,472]	{1,236}
Larimer	29,118	29,198	29,198	29,198	29,360	(5,872)	[1,409]	{705}	29,538	(5,908)	[1,418]	{709}	29,731	(5,946)	[1,427]	{714}
Pueblo	20,022	20,064	20,064	20,064	20,117	(4,023)	[966]	{483}	20,174	(4,035)	[968]	{484}	20,236	(4,047)	[971]	{486}
Weld	34,782	34,841	34,841	34,841	34,994	(6,999)	[1,680]	{840}	35,158	(7,032)	[1,688]	{844}	35,336	(7,067)	[1,696]	{848}

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.