

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

Date: 9/1/21

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 9/1/21 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.

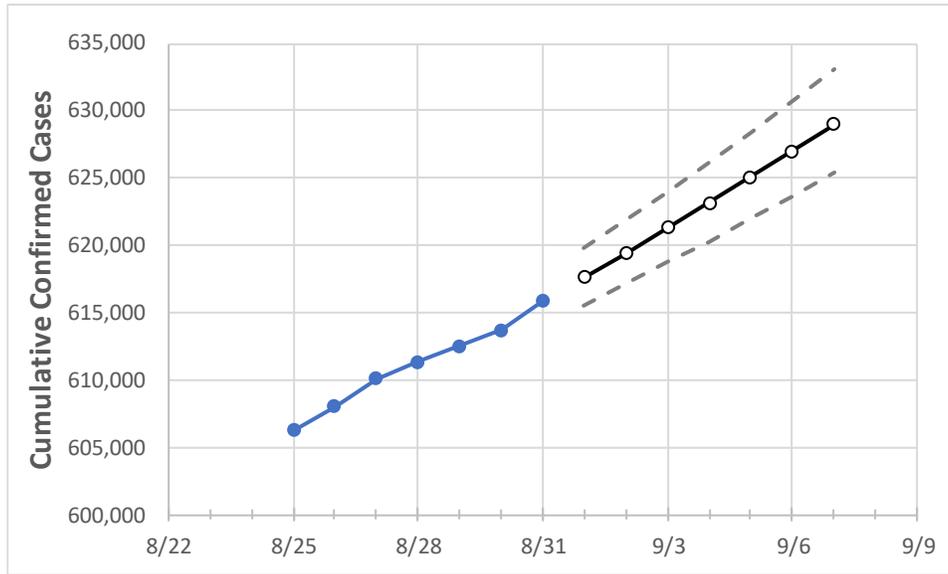
IEM's Modeling Lead

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Colorado	611,328	612,529	613,730	615,878	617,660	619,431	621,282	623,157	625,069	627,037	629,014

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Adams	65,975	66,093	66,212	66,413	66,601	66,790	66,981	67,184	67,388	67,600	67,812
Arapahoe	68,359	68,473	68,588	68,794	68,979	69,162	69,353	69,544	69,743	69,941	70,143
Boulder	26,184	26,223	26,261	26,363	26,429	26,497	26,563	26,632	26,700	26,770	26,842
Denver	80,330	80,441	80,551	80,760	80,944	81,136	81,329	81,519	81,715	81,917	82,113
Douglas	33,762	33,848	33,933	34,065	34,187	34,314	34,443	34,572	34,706	34,844	34,986
Eagle	7,129	7,145	7,160	7,220	7,251	7,278	7,308	7,338	7,370	7,401	7,433
El Paso	81,712	81,897	82,082	82,521	82,778	83,030	83,293	83,564	83,835	84,113	84,395
Gunnison	1,540	1,545	1,550	1,560	1,568	1,577	1,586	1,595	1,604	1,614	1,625
Jefferson	53,195	53,301	53,408	53,556	53,688	53,821	53,953	54,088	54,223	54,360	54,497
Larimer	31,325	31,419	31,512	31,620	31,754	31,889	32,026	32,169	32,310	32,462	32,614
Pueblo	20,727	20,756	20,785	20,846	20,887	20,930	20,973	21,016	21,061	21,109	21,154
Weld	37,163	37,290	37,416	37,539	37,691	37,847	38,004	38,167	38,335	38,507	38,685

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:											
	8/28	8/29	8/30	8/31	9/2				9/4				9/6			
Adams	65,975	66,093	66,212	66,413	66,790	(13,358)	[3,206]	{1,603}	67,184	(13,437)	[3,225]	{1,612}	67,600	(13,520)	[3,245]	{1,622}
Arapahoe	68,359	68,473	68,588	68,794	69,162	(13,832)	[3,320]	{1,660}	69,544	(13,909)	[3,338]	{1,669}	69,941	(13,988)	[3,357]	{1,679}
Boulder	26,184	26,223	26,261	26,363	26,497	(5,299)	[1,272]	{636}	26,632	(5,326)	[1,278]	{639}	26,770	(5,354)	[1,285]	{642}
Denver	80,330	80,441	80,551	80,760	81,136	(16,227)	[3,895]	{1,947}	81,519	(16,304)	[3,913]	{1,956}	81,917	(16,383)	[3,932]	{1,966}
Douglas	33,762	33,848	33,933	34,065	34,314	(6,863)	[1,647]	{824}	34,572	(6,914)	[1,659]	{830}	34,844	(6,969)	[1,673]	{836}
Eagle	7,129	7,145	7,160	7,220	7,278	(1,456)	[349]	{175}	7,338	(1,468)	[352]	{176}	7,401	(1,480)	[355]	{178}
El Paso	81,712	81,897	82,082	82,521	83,030	(16,606)	[3,985]	{1,993}	83,564	(16,713)	[4,011]	{2,006}	84,113	(16,823)	[4,037]	{2,019}
Gunnison	1,540	1,545	1,550	1,560	1,577	(315)	[76]	{38}	1,595	(319)	[77]	{38}	1,614	(323)	[77]	{39}
Jefferson	53,195	53,301	53,408	53,556	53,821	(10,764)	[2,583]	{1,292}	54,088	(10,818)	[2,596]	{1,298}	54,360	(10,872)	[2,609]	{1,305}
Larimer	31,325	31,419	31,512	31,620	31,889	(6,378)	[1,531]	{765}	32,169	(6,434)	[1,544]	{772}	32,462	(6,492)	[1,558]	{779}
Pueblo	20,727	20,756	20,785	20,846	20,930	(4,186)	[1,005]	{502}	21,016	(4,203)	[1,009]	{504}	21,109	(4,222)	[1,013]	{507}
Weld	37,163	37,290	37,416	37,539	37,847	(7,569)	[1,817]	{908}	38,167	(7,633)	[1,832]	{916}	38,507	(7,701)	[1,848]	{924}

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.