

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

Date: 3/19/21

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 3/19/21 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.

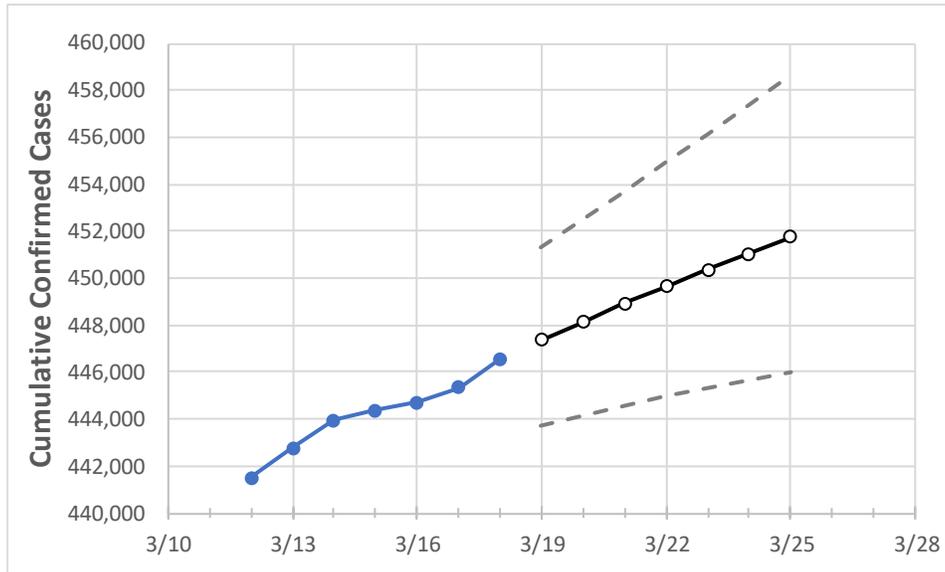
IEM's Modeling Lead

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Colorado	444,390	444,712	445,338	446,580	447,373	448,151	448,929	449,658	450,383	451,044	451,744

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Adams	49,866	49,895	49,978	50,118	50,188	50,258	50,325	50,390	50,452	50,515	50,577
Arapahoe	50,153	50,170	50,227	50,342	50,425	50,502	50,579	50,652	50,726	50,798	50,871
Boulder	19,606	19,616	19,641	19,743	19,788	19,833	19,878	19,920	19,964	20,006	20,048
Denver	61,859	61,880	61,899	62,050	62,162	62,272	62,380	62,484	62,587	62,687	62,791
Douglas	22,517	22,523	22,545	22,630	22,680	22,730	22,776	22,823	22,866	22,910	22,953
Eagle	5,398	5,415	5,431	5,468	5,487	5,505	5,523	5,541	5,558	5,576	5,593
El Paso	54,026	54,101	54,233	54,427	54,541	54,653	54,762	54,874	54,979	55,082	55,188
Gunnison	1,226	1,225	1,224	1,225	1,226	1,227	1,228	1,230	1,231	1,232	1,232
Jefferson	38,761	38,778	38,837	38,966	39,042	39,118	39,188	39,257	39,326	39,393	39,459
Larimer	21,075	21,080	21,096	21,139	21,178	21,215	21,251	21,287	21,319	21,352	21,383
Pueblo	15,357	15,364	15,399	15,427	15,447	15,466	15,486	15,505	15,523	15,541	15,560
Weld	26,457	26,474	26,514	26,584	26,629	26,676	26,721	26,764	26,805	26,848	26,888

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:											
	3/15	3/16	3/17	3/18	3/20				3/22				3/24			
Adams	49,866	49,895	49,978	50,118	50,258	(10,052)	[2,412]	{1,206}	50,390	(10,078)	[2,419]	{1,209}	50,515	(10,103)	[2,425]	{1,212}
Arapahoe	50,153	50,170	50,227	50,342	50,502	(10,100)	[2,424]	{1,212}	50,652	(10,130)	[2,431]	{1,216}	50,798	(10,160)	[2,438]	{1,219}
Boulder	19,606	19,616	19,641	19,743	19,833	(3,967)	[952]	{476}	19,920	(3,984)	[956]	{478}	20,006	(4,001)	[960]	{480}
Denver	61,859	61,880	61,899	62,050	62,272	(12,454)	[2,989]	{1,495}	62,484	(12,497)	[2,999]	{1,500}	62,687	(12,537)	[3,009]	{1,504}
Douglas	22,517	22,523	22,545	22,630	22,730	(4,546)	[1,091]	{546}	22,823	(4,565)	[1,096]	{548}	22,910	(4,582)	[1,100]	{550}
Eagle	5,398	5,415	5,431	5,468	5,505	(1,101)	[264]	{132}	5,541	(1,108)	[266]	{133}	5,576	(1,115)	[268]	{134}
El Paso	54,026	54,101	54,233	54,427	54,653	(10,931)	[2,623]	{1,312}	54,874	(10,975)	[2,634]	{1,317}	55,082	(11,016)	[2,644]	{1,322}
Gunnison	1,226	1,225	1,224	1,225	1,227	(245)	[59]	{29}	1,230	(246)	[59]	{30}	1,232	(246)	[59]	{30}
Jefferson	38,761	38,778	38,837	38,966	39,118	(7,824)	[1,878]	{939}	39,257	(7,851)	[1,884]	{942}	39,393	(7,879)	[1,891]	{945}
Larimer	21,075	21,080	21,096	21,139	21,215	(4,243)	[1,018]	{509}	21,287	(4,257)	[1,022]	{511}	21,352	(4,270)	[1,025]	{512}
Pueblo	15,357	15,364	15,399	15,427	15,466	(3,093)	[742]	{371}	15,505	(3,101)	[744]	{372}	15,541	(3,108)	[746]	{373}
Weld	26,457	26,474	26,514	26,584	26,676	(5,335)	[1,280]	{640}	26,764	(5,353)	[1,285]	{642}	26,848	(5,370)	[1,289]	{644}

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.