

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

Date: 8/4/21

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 8/4/21 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.

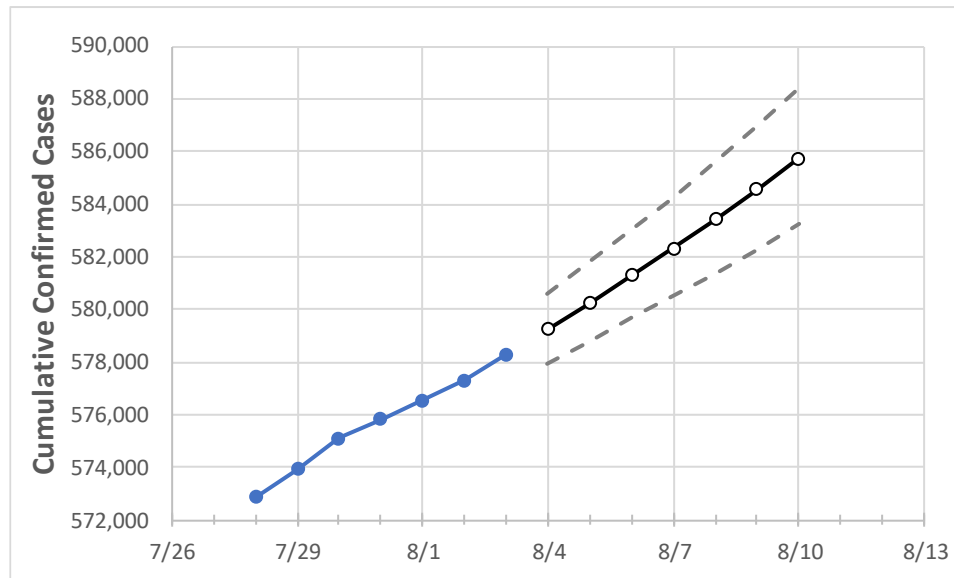
IEM's Modeling Lead

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Colorado	575,816	576,551	577,285	578,276	579,246	580,243	581,273	582,335	583,423	584,559	585,719

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Adams	62,501	62,567	62,633	62,752	62,847	62,945	63,048	63,153	63,265	63,380	63,502
Arapahoe	64,521	64,610	64,700	64,774	64,874	64,978	65,085	65,196	65,311	65,432	65,557
Boulder	24,764	24,797	24,830	24,861	24,907	24,955	25,005	25,057	25,111	25,165	25,222
Denver	76,204	76,299	76,393	76,534	76,670	76,814	76,967	77,125	77,292	77,468	77,654
Douglas	31,439	31,488	31,537	31,587	31,641	31,698	31,757	31,820	31,885	31,951	32,020
Eagle	6,535	6,543	6,551	6,561	6,571	6,583	6,594	6,606	6,617	6,631	6,644
El Paso	76,348	76,464	76,581	76,758	76,918	77,082	77,252	77,427	77,601	77,785	77,974
Gunnison	1,429	1,431	1,433	1,434	1,436	1,439	1,441	1,444	1,447	1,450	1,454
Jefferson	50,264	50,322	50,381	50,483	50,574	50,668	50,767	50,871	50,979	51,093	51,210
Larimer	28,828	28,874	28,920	28,982	29,045	29,110	29,176	29,246	29,317	29,391	29,469
Pueblo	19,949	19,963	19,977	19,993	20,013	20,033	20,054	20,076	20,098	20,121	20,144
Weld	34,498	34,548	34,598	34,656	34,718	34,782	34,849	34,918	34,990	35,066	35,144

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:							
	7/31	8/1	8/2	8/3	8/5		8/7		8/9			
Adams	62,501	62,567	62,633	62,752	62,945	(12,589) [3,021] {1,511}	63,153	(12,631) [3,031] {1,516}	63,380	(12,676) [3,042] {1,521}		
Arapahoe	64,521	64,610	64,700	64,774	64,978	(12,996) [3,119] {1,559}	65,196	(13,039) [3,129] {1,565}	65,432	(13,086) [3,141] {1,570}		
Boulder	24,764	24,797	24,830	24,861	24,955	(4,991) [1,198] {599}	25,057	(5,011) [1,203] {601}	25,165	(5,033) [1,208] {604}		
Denver	76,204	76,299	76,393	76,534	76,814	(15,363) [3,687] {1,844}	77,125	(15,425) [3,702] {1,851}	77,468	(15,494) [3,718] {1,859}		
Douglas	31,439	31,488	31,537	31,587	31,698	(6,340) [1,521] {761}	31,820	(6,364) [1,527] {764}	31,951	(6,390) [1,534] {767}		
Eagle	6,535	6,543	6,551	6,561	6,583	(1,317) [316] {158}	6,606	(1,321) [317] {159}	6,631	(1,326) [318] {159}		
El Paso	76,348	76,464	76,581	76,758	77,082	(15,416) [3,700] {1,850}	77,427	(15,485) [3,716] {1,858}	77,785	(15,557) [3,734] {1,867}		
Gunnison	1,429	1,431	1,433	1,434	1,439	(288) [69] {35}	1,444	(289) [69] {35}	1,450	(290) [70] {35}		
Jefferson	50,264	50,322	50,381	50,483	50,668	(10,134) [2,432] {1,216}	50,871	(10,174) [2,442] {1,221}	51,093	(10,219) [2,452] {1,226}		
Larimer	28,828	28,874	28,920	28,982	29,110	(5,822) [1,397] {699}	29,246	(5,849) [1,404] {702}	29,391	(5,878) [1,411] {705}		
Pueblo	19,949	19,963	19,977	19,993	20,033	(4,007) [962] {481}	20,076	(4,015) [964] {482}	20,121	(4,024) [966] {483}		
Weld	34,498	34,548	34,598	34,656	34,782	(6,956) [1,670] {835}	34,918	(6,984) [1,676] {838}	35,066	(7,013) [1,683] {842}		

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.