

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

Date: 6/1/21

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 6/1/21 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.

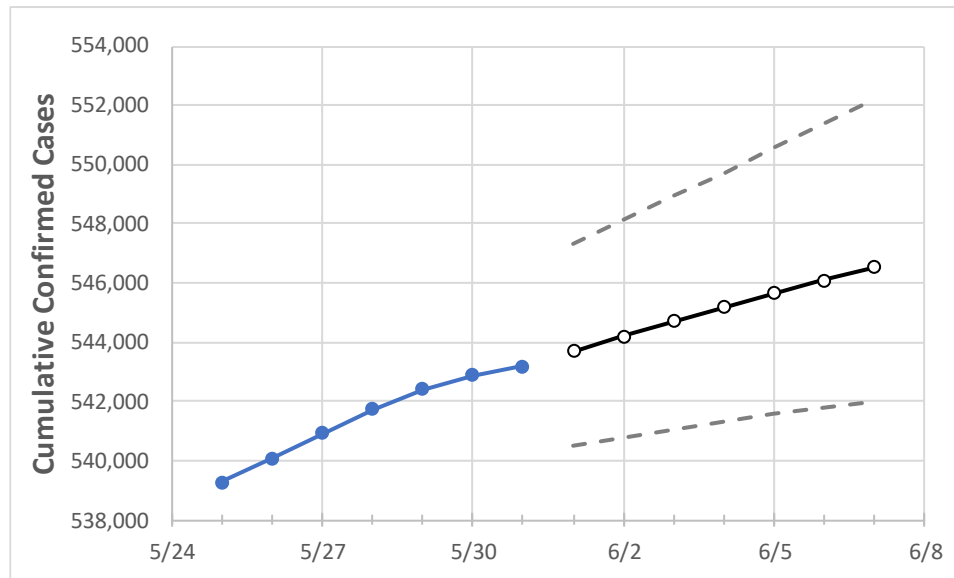
IEM's Modeling Lead

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Colorado	541,726	542,405	542,889	543,174	543,689	544,209	544,696	545,178	545,643	546,086	546,514

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Adams	59,661	59,705	59,741	59,771	59,818	59,860	59,901	59,939	59,975	60,010	60,043
Arapahoe	61,334	61,397	61,448	61,469	61,527	61,581	61,632	61,685	61,733	61,780	61,825
Boulder	23,626	23,658	23,667	23,675	23,689	23,702	23,716	23,728	23,741	23,752	23,764
Denver	72,985	73,055	73,101	73,118	73,154	73,188	73,222	73,251	73,280	73,309	73,337
Douglas	29,465	29,499	29,531	29,540	29,568	29,596	29,622	29,648	29,672	29,696	29,720
Eagle	6,317	6,321	6,322	6,323	6,325	6,327	6,328	6,330	6,331	6,333	6,334
El Paso	70,122	70,244	70,339	70,400	70,550	70,696	70,837	70,977	71,108	71,237	71,367
Gunnison	1,349	1,350	1,351	1,352	1,353	1,354	1,355	1,355	1,356	1,357	1,358
Jefferson	47,862	47,914	47,943	47,963	47,996	48,028	48,057	48,084	48,112	48,136	48,159
Larimer	26,909	26,942	26,965	26,978	26,999	27,018	27,036	27,054	27,071	27,087	27,102
Pueblo	19,055	19,079	19,088	19,094	19,110	19,126	19,140	19,154	19,167	19,180	19,192
Weld	32,464	32,522	32,551	32,578	32,614	32,648	32,681	32,714	32,746	32,776	32,805

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:							
	5/28	5/29	5/30	5/31	6/2		6/4		6/6			
Adams	59,661	59,705	59,741	59,771	59,860	(11,972) [2,873] {1,437}	59,939	(11,988) [2,877] {1,439}	60,010	(12,002) [2,880] {1,440}		
Arapahoe	61,334	61,397	61,448	61,469	61,581	(12,316) [2,956] {1,478}	61,685	(12,337) [2,961] {1,480}	61,780	(12,356) [2,965] {1,483}		
Boulder	23,626	23,658	23,667	23,675	23,702	(4,740) [1,138] {569}	23,728	(4,746) [1,139] {569}	23,752	(4,750) [1,140] {570}		
Denver	72,985	73,055	73,101	73,118	73,188	(14,638) [3,513] {1,757}	73,251	(14,650) [3,516] {1,758}	73,309	(14,662) [3,519] {1,759}		
Douglas	29,465	29,499	29,531	29,540	29,596	(5,919) [1,421] {710}	29,648	(5,930) [1,423] {712}	29,696	(5,939) [1,425] {713}		
Eagle	6,317	6,321	6,322	6,323	6,327	(1,265) [304] {152}	6,330	(1,266) [304] {152}	6,333	(1,267) [304] {152}		
El Paso	70,122	70,244	70,339	70,400	70,696	(14,139) [3,393] {1,697}	70,977	(14,195) [3,407] {1,703}	71,237	(14,247) [3,419] {1,710}		
Gunnison	1,349	1,350	1,351	1,352	1,354	(271) [65] {32}	1,355	(271) [65] {33}	1,357	(271) [65] {33}		
Jefferson	47,862	47,914	47,943	47,963	48,028	(9,606) [2,305] {1,153}	48,084	(9,617) [2,308] {1,154}	48,136	(9,627) [2,311] {1,155}		
Larimer	26,909	26,942	26,965	26,978	27,018	(5,404) [1,297] {648}	27,054	(5,411) [1,299] {649}	27,087	(5,417) [1,300] {650}		
Pueblo	19,055	19,079	19,088	19,094	19,126	(3,825) [918] {459}	19,154	(3,831) [919] {460}	19,180	(3,836) [921] {460}		
Weld	32,464	32,522	32,551	32,578	32,648	(6,530) [1,567] {784}	32,714	(6,543) [1,570] {785}	32,776	(6,555) [1,573] {787}		

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.