

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

Date: 6/7/21

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 6/7/21 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.

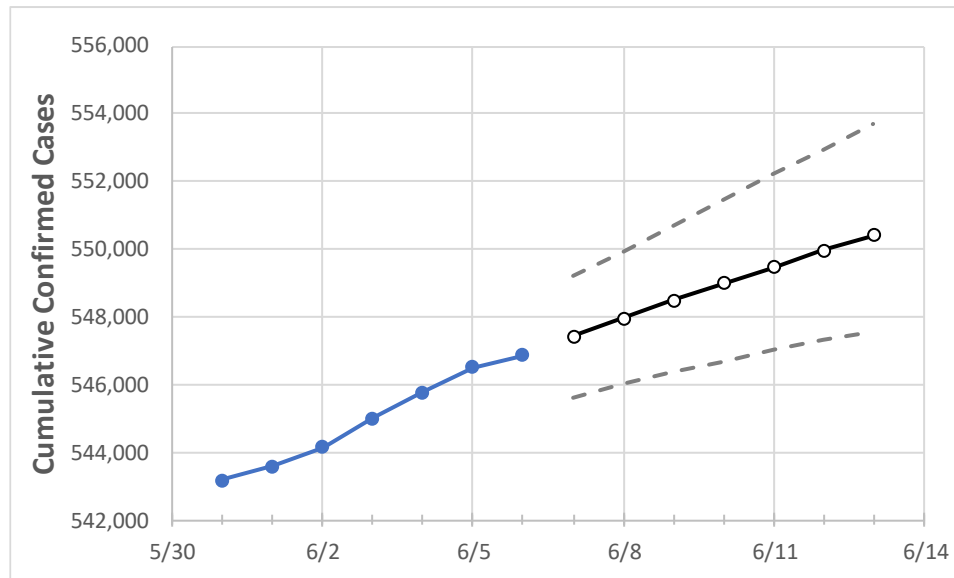
IEM's Modeling Lead

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:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Colorado	545,002	545,769	546,500	546,874	547,417	547,950	548,479	548,980	549,474	549,953	550,409

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:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Adams	59,877	59,951	60,017	60,049	60,084	60,116	60,148	60,177	60,206	60,233	60,260
Arapahoe	61,644	61,706	61,768	61,794	61,840	61,885	61,929	61,972	62,010	62,048	62,084
Boulder	23,710	23,734	23,753	23,763	23,779	23,794	23,809	23,823	23,837	23,851	23,864
Denver	73,257	73,310	73,389	73,437	73,483	73,529	73,576	73,619	73,664	73,707	73,750
Douglas	29,645	29,712	29,763	29,774	29,806	29,839	29,871	29,903	29,933	29,963	29,996
Eagle	6,321	6,324	6,324	6,324	6,326	6,327	6,329	6,330	6,332	6,333	6,335
El Paso	70,859	70,987	71,132	71,206	71,329	71,445	71,564	71,674	71,783	71,889	71,991
Gunnison	1,353	1,354	1,354	1,358	1,359	1,360	1,361	1,363	1,364	1,365	1,366
Jefferson	48,071	48,125	48,190	48,209	48,243	48,275	48,307	48,337	48,366	48,394	48,421
Larimer	27,065	27,100	27,131	27,143	27,166	27,189	27,211	27,233	27,253	27,274	27,294
Pueblo	19,156	19,174	19,190	19,202	19,217	19,232	19,246	19,260	19,273	19,286	19,299
Weld	32,710	32,758	32,801	32,824	32,860	32,896	32,931	32,965	32,998	33,031	33,062

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:							
	6/3	6/4	6/5	6/6	6/8		6/10		6/12			
Adams	59,877	59,951	60,017	60,049	60,116	{12,023} [2,886] {1,443}	60,177	{12,035} [2,888] {1,444}	60,233	{12,047} [2,891] {1,446}		
Arapahoe	61,644	61,706	61,768	61,794	61,885	{12,377} [2,970] {1,485}	61,972	{12,394} [2,975] {1,487}	62,048	{12,410} [2,978] {1,489}		
Boulder	23,710	23,734	23,753	23,763	23,794	{4,759} [1,142] {571}	23,823	{4,765} [1,143] {572}	23,851	{4,770} [1,145] {572}		
Denver	73,257	73,310	73,389	73,437	73,529	{14,706} [3,529] {1,765}	73,619	{14,724} [3,534] {1,767}	73,707	{14,741} [3,538] {1,769}		
Douglas	29,645	29,712	29,763	29,774	29,839	{5,968} [1,432] {716}	29,903	{5,981} [1,435] {718}	29,963	{5,993} [1,438] {719}		
Eagle	6,321	6,324	6,324	6,324	6,327	{1,265} [304] {152}	6,330	{1,266} [304] {152}	6,333	{1,267} [304] {152}		
El Paso	70,859	70,987	71,132	71,206	71,445	{14,289} [3,429] {1,715}	71,674	{14,335} [3,440] {1,720}	71,889	{14,378} [3,451] {1,725}		
Gunnison	1,353	1,354	1,354	1,358	1,360	{272} [65] {33}	1,363	{273} [65] {33}	1,365	{273} [66] {33}		
Jefferson	48,071	48,125	48,190	48,209	48,275	{9,655} [2,317] {1,159}	48,337	{9,667} [2,320] {1,160}	48,394	{9,679} [2,323] {1,161}		
Larimer	27,065	27,100	27,131	27,143	27,189	{5,438} [1,305] {653}	27,233	{5,447} [1,307] {654}	27,274	{5,455} [1,309] {655}		
Pueblo	19,156	19,174	19,190	19,202	19,232	{3,846} [923] {462}	19,260	{3,852} [924] {462}	19,286	{3,857} [926] {463}		
Weld	32,710	32,758	32,801	32,824	32,896	{6,579} [1,579] {789}	32,965	{6,593} [1,582] {791}	33,031	{6,606} [1,585] {793}		

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.