

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

Date: 9/27/21

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 9/27/21 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.

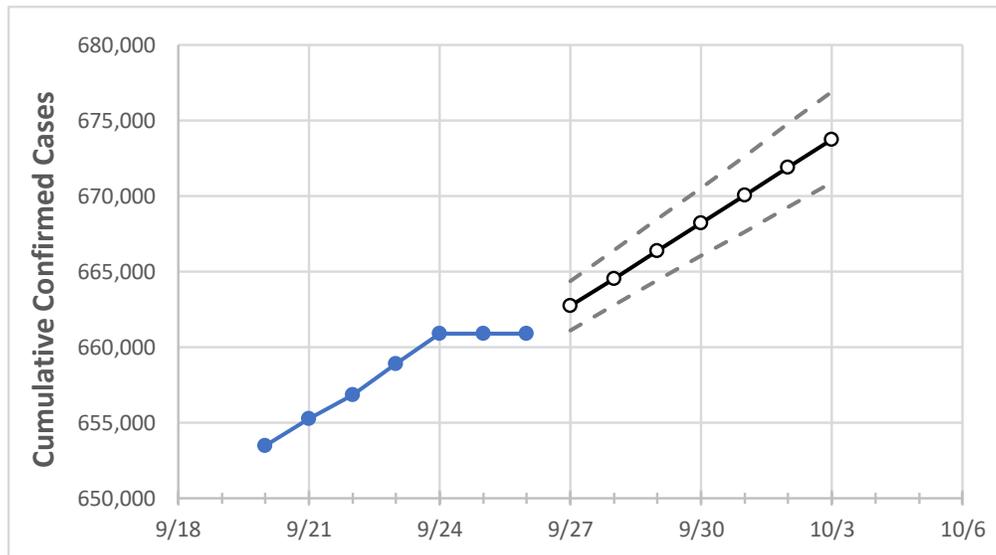
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Colorado	658,906	660,884	660,884	660,884	662,725	664,540	666,387	668,199	670,061	671,878	673,728

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Adams	69,922	70,052	70,052	70,052	70,186	70,319	70,450	70,581	70,710	70,840	70,968
Arapahoe	72,907	73,090	73,090	73,090	73,235	73,378	73,519	73,658	73,796	73,935	74,069
Boulder	28,092	28,179	28,179	28,179	28,242	28,303	28,364	28,426	28,485	28,547	28,607
Denver	84,625	84,843	84,843	84,843	85,012	85,182	85,353	85,521	85,694	85,870	86,042
Douglas	36,598	36,714	36,714	36,714	36,808	36,901	36,995	37,088	37,183	37,278	37,370
Eagle	7,807	7,825	7,825	7,825	7,840	7,854	7,867	7,880	7,893	7,906	7,918
El Paso	89,681	89,984	89,984	89,984	90,289	90,595	90,899	91,202	91,502	91,805	92,114
Gunnison	1,711	1,716	1,716	1,716	1,722	1,728	1,734	1,739	1,745	1,751	1,757
Jefferson	57,195	57,362	57,362	57,362	57,539	57,718	57,896	58,079	58,259	58,444	58,631
Larimer	34,429	34,582	34,582	34,582	34,705	34,830	34,952	35,076	35,203	35,330	35,454
Pueblo	22,181	22,255	22,255	22,255	22,321	22,389	22,456	22,527	22,596	22,668	22,738
Weld	41,001	41,120	41,120	41,120	41,258	41,393	41,529	41,662	41,799	41,932	42,070

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:											
	9/23	9/24	9/25	9/26	9/28				9/30				10/2			
Adams	69,922	70,052	70,052	70,052	70,319	(14,064)	[3,375]	{1,688}	70,581	(14,116)	[3,388]	{1,694}	70,840	(14,168)	[3,400]	{1,700}
Arapahoe	72,907	73,090	73,090	73,090	73,378	(14,676)	[3,522]	{1,761}	73,658	(14,732)	[3,536]	{1,768}	73,935	(14,787)	[3,549]	{1,774}
Boulder	28,092	28,179	28,179	28,179	28,303	(5,661)	[1,359]	{679}	28,426	(5,685)	[1,364]	{682}	28,547	(5,709)	[1,370]	{685}
Denver	84,625	84,843	84,843	84,843	85,182	(17,036)	[4,089]	{2,044}	85,521	(17,104)	[4,105]	{2,053}	85,870	(17,174)	[4,122]	{2,061}
Douglas	36,598	36,714	36,714	36,714	36,901	(7,380)	[1,771]	{886}	37,088	(7,418)	[1,780]	{890}	37,278	(7,456)	[1,789]	{895}
Eagle	7,807	7,825	7,825	7,825	7,854	(1,571)	[377]	{188}	7,880	(1,576)	[378]	{189}	7,906	(1,581)	[380]	{190}
El Paso	89,681	89,984	89,984	89,984	90,595	(18,119)	[4,349]	{2,174}	91,202	(18,240)	[4,378]	{2,189}	91,805	(18,361)	[4,407]	{2,203}
Gunnison	1,711	1,716	1,716	1,716	1,728	(346)	[83]	{41}	1,739	(348)	[83]	{42}	1,751	(350)	[84]	{42}
Jefferson	57,195	57,362	57,362	57,362	57,718	(11,544)	[2,770]	{1,385}	58,079	(11,616)	[2,788]	{1,394}	58,444	(11,689)	[2,805]	{1,403}
Larimer	34,429	34,582	34,582	34,582	34,830	(6,966)	[1,672]	{836}	35,076	(7,015)	[1,684]	{842}	35,330	(7,066)	[1,696]	{848}
Pueblo	22,181	22,255	22,255	22,255	22,389	(4,478)	[1,075]	{537}	22,527	(4,505)	[1,081]	{541}	22,668	(4,534)	[1,088]	{544}
Weld	41,001	41,120	41,120	41,120	41,393	(8,279)	[1,987]	{993}	41,662	(8,332)	[2,000]	{1,000}	41,932	(8,386)	[2,013]	{1,006}

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.