

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

Date: 3/10/21

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 3/10/21 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.**

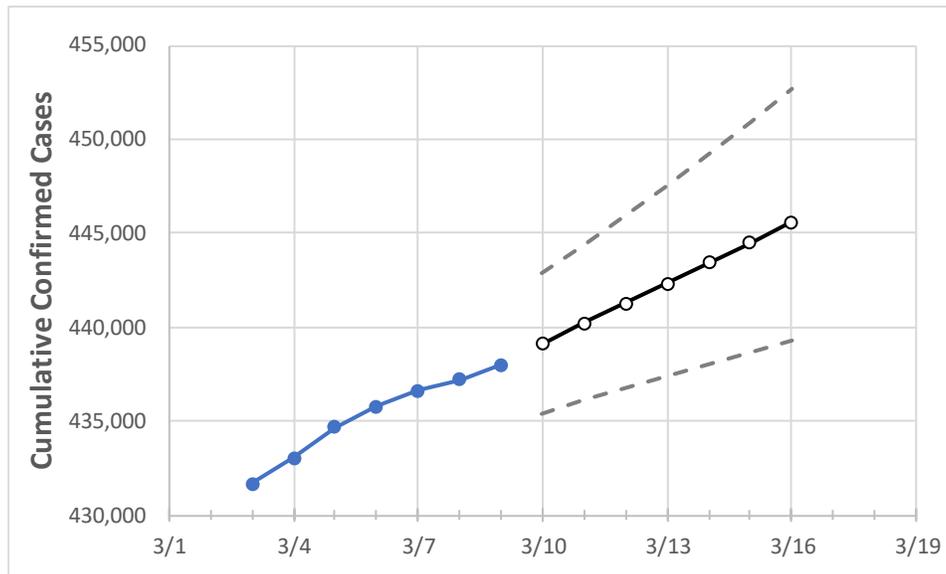
### IEM's Modeling Lead

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:							
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	
Colorado	435,762	436,612	437,187	438,025	439,128	440,190	441,289	442,352	443,420	444,510	445,611	

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:							
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	
Adams	49,123	49,215	49,259	49,325	49,427	49,531	49,632	49,734	49,834	49,936	50,036	
Arapahoe	49,234	49,321	49,374	49,452	49,560	49,666	49,773	49,876	49,978	50,079	50,181	
Boulder	19,148	19,193	19,222	19,262	19,312	19,362	19,412	19,459	19,509	19,556	19,606	
Denver	60,505	60,614	60,715	60,810	60,951	61,087	61,229	61,373	61,512	61,648	61,786	
Douglas	21,897	21,966	22,024	22,078	22,163	22,250	22,337	22,424	22,511	22,597	22,686	
Eagle	5,224	5,242	5,265	5,289	5,314	5,339	5,363	5,388	5,413	5,438	5,463	
El Paso	52,976	53,078	53,140	53,258	53,396	53,535	53,670	53,810	53,951	54,090	54,225	
Gunnison	1,212	1,213	1,213	1,214	1,215	1,216	1,217	1,217	1,218	1,219	1,219	
Jefferson	37,933	38,033	38,093	38,165	38,283	38,402	38,524	38,645	38,773	38,902	39,032	
Larimer	20,524	20,589	20,628	20,673	20,741	20,807	20,872	20,937	21,001	21,065	21,128	
Pueblo	15,177	15,186	15,195	15,250	15,274	15,297	15,321	15,345	15,367	15,391	15,416	
Weld	25,926	25,983	26,018	26,099	26,171	26,244	26,320	26,394	26,469	26,544	26,619	

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:											
	3/6	3/7	3/8	3/9	3/11			3/13			3/15					
Adams	49,123	49,215	49,259	49,325	49,531	(9,906)	[2,377]	{1,189}	49,734	(9,947)	[2,387]	{1,194}	49,936	(9,987)	[2,397]	{1,198}
Arapahoe	49,234	49,321	49,374	49,452	49,666	(9,933)	[2,384]	{1,192}	49,876	(9,975)	[2,394]	{1,197}	50,079	(10,016)	[2,404]	{1,202}
Boulder	19,148	19,193	19,222	19,262	19,362	(3,872)	[929]	{465}	19,459	(3,892)	[934]	{467}	19,556	(3,911)	[939]	{469}
Denver	60,505	60,614	60,715	60,810	61,087	(12,217)	[2,932]	{1,466}	61,373	(12,275)	[2,946]	{1,473}	61,648	(12,330)	[2,959]	{1,480}
Douglas	21,897	21,966	22,024	22,078	22,250	(4,450)	[1,068]	{534}	22,424	(4,485)	[1,076]	{538}	22,597	(4,519)	[1,085]	{542}
Eagle	5,224	5,242	5,265	5,289	5,339	(1,068)	[256]	{128}	5,388	(1,078)	[259]	{129}	5,438	(1,088)	[261]	{131}
El Paso	52,976	53,078	53,140	53,258	53,535	(10,707)	[2,570]	{1,285}	53,810	(10,762)	[2,583]	{1,291}	54,090	(10,818)	[2,596]	{1,298}
Gunnison	1,212	1,213	1,213	1,214	1,216	(243)	[58]	{29}	1,217	(243)	[58]	{29}	1,219	(244)	[58]	{29}
Jefferson	37,933	38,033	38,093	38,165	38,402	(7,680)	[1,843]	{922}	38,645	(7,729)	[1,855]	{927}	38,902	(7,780)	[1,867]	{934}
Larimer	20,524	20,589	20,628	20,673	20,807	(4,161)	[999]	{499}	20,937	(4,187)	[1,005]	{502}	21,065	(4,213)	[1,011]	{506}
Pueblo	15,177	15,186	15,195	15,250	15,297	(3,059)	[734]	{367}	15,345	(3,069)	[737]	{368}	15,391	(3,078)	[739]	{369}
Weld	25,926	25,983	26,018	26,099	26,244	(5,249)	[1,260]	{630}	26,394	(5,279)	[1,267]	{633}	26,544	(5,309)	[1,274]	{637}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.