

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

**Date: 3/9/21**

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 3/9/21 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.**

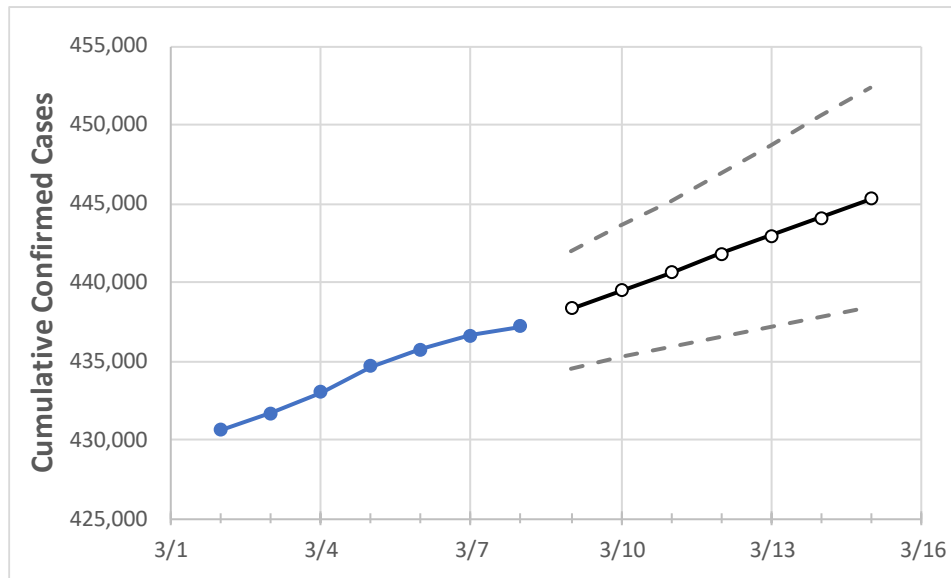
### **IEM's Modeling Lead**

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:							
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	
Colorado	434,654	435,762	436,612	437,187	438,333	439,481	440,633	441,801	442,954	444,118	445,299	

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:							
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	
Adams	49,045	49,123	49,215	49,259	49,370	49,485	49,600	49,715	49,831	49,946	50,061	
Arapahoe	49,139	49,234	49,321	49,374	49,487	49,601	49,711	49,826	49,938	50,050	50,163	
Boulder	19,098	19,148	19,193	19,222	19,273	19,323	19,374	19,426	19,477	19,530	19,583	
Denver	60,389	60,505	60,614	60,715	60,856	60,993	61,133	61,279	61,426	61,576	61,726	
Douglas	21,786	21,897	21,966	22,024	22,116	22,209	22,302	22,400	22,495	22,594	22,691	
Eagle	5,198	5,224	5,242	5,265	5,289	5,314	5,339	5,364	5,388	5,413	5,437	
El Paso	52,787	52,976	53,078	53,140	53,285	53,429	53,575	53,717	53,860	54,002	54,142	
Gunnison	1,212	1,212	1,212	1,212	1,213	1,214	1,216	1,217	1,218	1,219	1,219	
Jefferson	37,809	37,933	38,033	38,093	38,220	38,349	38,481	38,616	38,751	38,889	39,031	
Larimer	20,441	20,524	20,589	20,628	20,699	20,770	20,839	20,910	20,979	21,049	21,118	
Pueblo	15,167	15,177	15,186	15,195	15,215	15,235	15,255	15,275	15,295	15,314	15,333	
Weld	25,856	25,926	25,983	26,018	26,088	26,157	26,228	26,298	26,370	26,440	26,514	

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:											
	3/5	3/6	3/7	3/8	3/10				3/12				3/14			
Adams	49,045	49,123	49,215	49,259	49,485	(9,897)	[2,375]	{1,188}	49,715	(9,943)	[2,386]	{1,193}	49,946	(9,989)	[2,397]	{1,199}
Arapahoe	49,139	49,234	49,321	49,374	49,601	(9,920)	[2,381]	{1,190}	49,826	(9,965)	[2,392]	{1,196}	50,050	(10,010)	[2,402]	{1,201}
Boulder	19,098	19,148	19,193	19,222	19,323	(3,865)	[927]	{464}	19,426	(3,885)	[932]	{466}	19,530	(3,906)	[937]	{469}
Denver	60,389	60,505	60,614	60,715	60,993	(12,199)	[2,928]	{1,464}	61,279	(12,256)	[2,941]	{1,471}	61,576	(12,315)	[2,956]	{1,478}
Douglas	21,786	21,897	21,966	22,024	22,209	(4,442)	[1,066]	{533}	22,400	(4,480)	[1,075]	{538}	22,594	(4,519)	[1,085]	{542}
Eagle	5,198	5,224	5,242	5,265	5,314	(1,063)	[255]	{128}	5,364	(1,073)	[257]	{129}	5,413	(1,083)	[260]	{130}
El Paso	52,787	52,976	53,078	53,140	53,429	(10,686)	[2,565]	{1,282}	53,717	(10,743)	[2,578]	{1,289}	54,002	(10,800)	[2,592]	{1,296}
Gunnison	1,212	1,212	1,212	1,212	1,214	(243)	[58]	{29}	1,217	(243)	[58]	{29}	1,219	(244)	[58]	{29}
Jefferson	37,809	37,933	38,033	38,093	38,349	(7,670)	[1,841]	{920}	38,616	(7,723)	[1,854]	{927}	38,889	(7,778)	[1,867]	{933}
Larimer	20,441	20,524	20,589	20,628	20,770	(4,154)	[997]	{498}	20,910	(4,182)	[1,004]	{502}	21,049	(4,210)	[1,010]	{505}
Pueblo	15,167	15,177	15,186	15,195	15,235	(3,047)	[731]	{366}	15,275	(3,055)	[733]	{367}	15,314	(3,063)	[735]	{368}
Weld	25,856	25,926	25,983	26,018	26,157	(5,231)	[1,256]	{628}	26,298	(5,260)	[1,262]	{631}	26,440	(5,288)	[1,269]	{635}

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.