

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

Date: 3/4/21

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 3/4/21 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.**

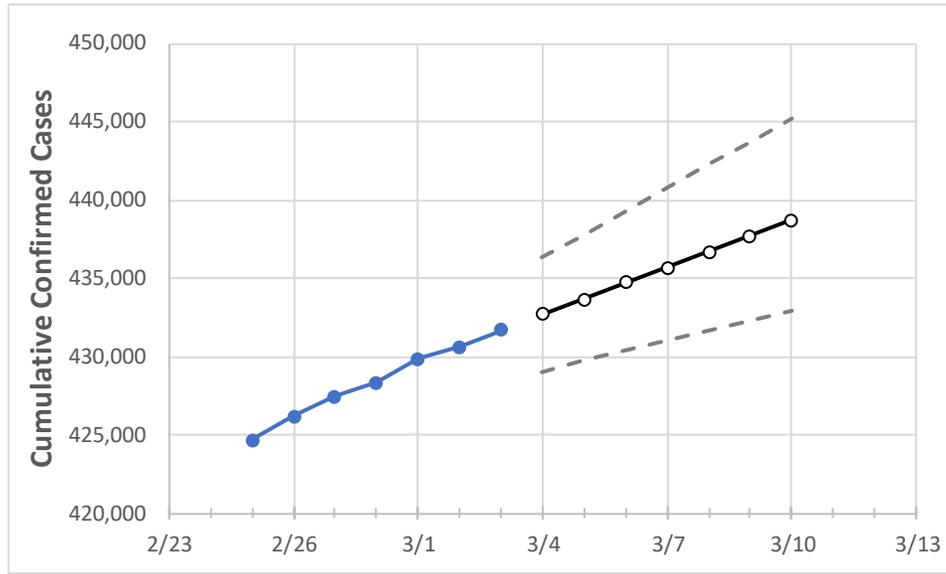
### IEM's Modeling Lead

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:							
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	
Colorado	428,303	429,839	430,615	431,670	432,678	433,669	434,698	435,700	436,700	437,715	438,699	

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:							
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	
Adams	48,413	48,560	48,635	48,730	48,835	48,939	49,046	49,151	49,255	49,362	49,471	
Arapahoe	48,463	48,640	48,715	48,795	48,905	49,015	49,124	49,232	49,340	49,451	49,554	
Boulder	18,799	18,888	18,910	18,975	19,020	19,065	19,110	19,154	19,199	19,243	19,286	
Denver	59,584	59,779	59,842	59,959	60,086	60,213	60,345	60,477	60,601	60,734	60,862	
Douglas	21,327	21,402	21,463	21,552	21,623	21,691	21,759	21,828	21,896	21,962	22,029	
Eagle	5,065	5,088	5,120	5,148	5,173	5,198	5,224	5,249	5,275	5,302	5,327	
El Paso	51,975	52,145	52,264	52,422	52,566	52,713	52,862	53,004	53,151	53,293	53,435	
Gunnison	1,203	1,205	1,207	1,211	1,213	1,215	1,217	1,218	1,220	1,222	1,223	
Jefferson	37,202	37,323	37,380	37,452	37,540	37,627	37,714	37,799	37,887	37,975	38,062	
Larimer	20,072	20,153	20,234	20,300	20,381	20,461	20,541	20,623	20,703	20,785	20,868	
Pueblo	15,007	15,046	15,058	15,110	15,128	15,144	15,161	15,176	15,192	15,207	15,222	
Weld	25,465	25,562	25,613	25,698	25,767	25,837	25,908	25,977	26,048	26,119	26,191	

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:											
	2/28	3/1	3/2	3/3	3/5			3/7			3/9					
Adams	48,413	48,560	48,635	48,730	48,939	(9,788)	[2,349]	{1,175}	49,151	(9,830)	[2,359]	{1,180}	49,362	(9,872)	[2,369]	{1,185}
Arapahoe	48,463	48,640	48,715	48,795	49,015	(9,803)	[2,353]	{1,176}	49,232	(9,846)	[2,363]	{1,182}	49,451	(9,890)	[2,374]	{1,187}
Boulder	18,799	18,888	18,910	18,975	19,065	(3,813)	[915]	{458}	19,154	(3,831)	[919]	{460}	19,243	(3,849)	[924]	{462}
Denver	59,584	59,779	59,842	59,959	60,213	(12,043)	[2,890]	{1,445}	60,477	(12,095)	[2,903]	{1,451}	60,734	(12,147)	[2,915]	{1,458}
Douglas	21,327	21,402	21,463	21,552	21,691	(4,338)	[1,041]	{521}	21,828	(4,366)	[1,048]	{524}	21,962	(4,392)	[1,054]	{527}
Eagle	5,065	5,088	5,120	5,148	5,198	(1,040)	[250]	{125}	5,249	(1,050)	[252]	{126}	5,302	(1,060)	[254]	{127}
El Paso	51,975	52,145	52,264	52,422	52,713	(10,543)	[2,530]	{1,265}	53,004	(10,601)	[2,544]	{1,272}	53,293	(10,659)	[2,558]	{1,279}
Gunnison	1,203	1,205	1,207	1,211	1,215	(243)	[58]	{29}	1,218	(244)	[58]	{29}	1,222	(244)	[59]	{29}
Jefferson	37,202	37,323	37,380	37,452	37,627	(7,525)	[1,806]	{903}	37,799	(7,560)	[1,814]	{907}	37,975	(7,595)	[1,823]	{911}
Larimer	20,072	20,153	20,234	20,300	20,461	(4,092)	[982]	{491}	20,623	(4,125)	[990]	{495}	20,785	(4,157)	[998]	{499}
Pueblo	15,007	15,046	15,058	15,110	15,144	(3,029)	[727]	{363}	15,176	(3,035)	[728]	{364}	15,207	(3,041)	[730]	{365}
Weld	25,465	25,562	25,613	25,698	25,837	(5,167)	[1,240]	{620}	25,977	(5,195)	[1,247]	{623}	26,119	(5,224)	[1,254]	{627}

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.