

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

Date: 6/14/21

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 6/14/21 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.**

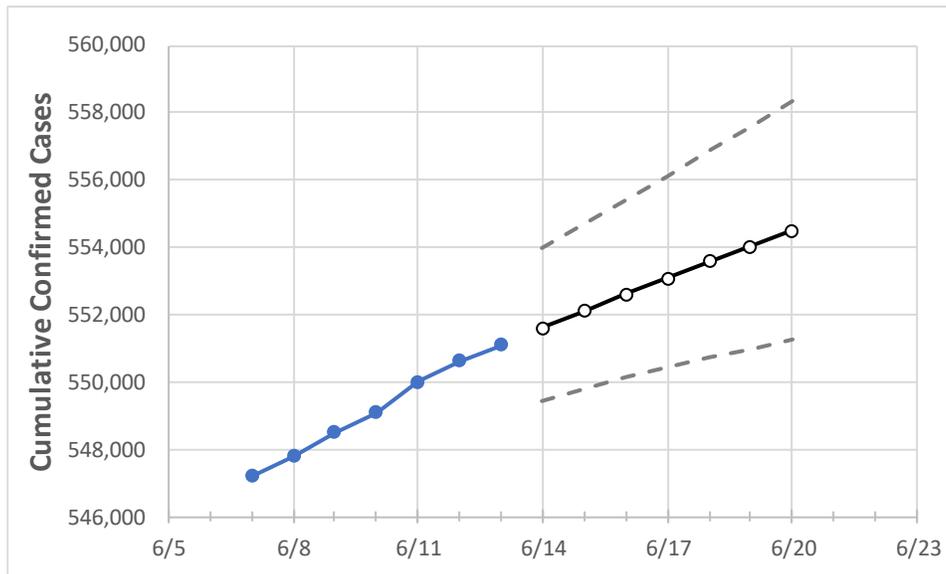
### IEM's Modeling Lead

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Colorado	549,084	550,014	550,618	551,091	551,607	552,105	552,597	553,094	553,574	554,038	554,505

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Adams	60,189	60,279	60,332	60,369	60,404	60,436	60,468	60,498	60,528	60,557	60,586
Arapahoe	62,005	62,080	62,152	62,182	62,225	62,265	62,306	62,345	62,385	62,423	62,459
Boulder	23,811	23,842	23,850	23,855	23,867	23,879	23,890	23,902	23,913	23,925	23,936
Denver	73,619	73,764	73,831	73,876	73,933	73,988	74,045	74,101	74,158	74,213	74,270
Douglas	29,956	29,986	30,032	30,052	30,087	30,121	30,156	30,189	30,222	30,256	30,289
Eagle	6,334	6,337	6,340	6,341	6,343	6,344	6,346	6,348	6,349	6,351	6,352
El Paso	71,698	71,873	71,977	72,095	72,202	72,309	72,412	72,516	72,616	72,713	72,810
Gunnison	1,368	1,369	1,370	1,371	1,373	1,374	1,376	1,378	1,379	1,381	1,383
Jefferson	48,351	48,410	48,452	48,497	48,528	48,559	48,588	48,616	48,643	48,670	48,697
Larimer	27,253	27,295	27,326	27,338	27,360	27,382	27,402	27,424	27,444	27,465	27,485
Pueblo	19,264	19,341	19,369	19,406	19,429	19,453	19,476	19,500	19,523	19,547	19,571
Weld	32,956	33,010	33,043	33,063	33,094	33,125	33,154	33,183	33,212	33,240	33,267

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:											
	6/10	6/11	6/12	6/13	6/15				6/17				6/19			
Adams	60,189	60,279	60,332	60,369	60,436	(12,087)	[2,901]	{1,450}	60,498	(12,100)	[2,904]	{1,452}	60,557	(12,111)	[2,907]	{1,453}
Arapahoe	62,005	62,080	62,152	62,182	62,265	(12,453)	[2,989]	{1,494}	62,345	(12,469)	[2,993]	{1,496}	62,423	(12,485)	[2,996]	{1,498}
Boulder	23,811	23,842	23,850	23,855	23,879	(4,776)	[1,146]	{573}	23,902	(4,780)	[1,147]	{574}	23,925	(4,785)	[1,148]	{574}
Denver	73,619	73,764	73,831	73,876	73,988	(14,798)	[3,551]	{1,776}	74,101	(14,820)	[3,557]	{1,778}	74,213	(14,843)	[3,562]	{1,781}
Douglas	29,956	29,986	30,032	30,052	30,121	(6,024)	[1,446]	{723}	30,189	(6,038)	[1,449]	{725}	30,256	(6,051)	[1,452]	{726}
Eagle	6,334	6,337	6,340	6,341	6,344	(1,269)	[305]	{152}	6,348	(1,270)	[305]	{152}	6,351	(1,270)	[305]	{152}
El Paso	71,698	71,873	71,977	72,095	72,309	(14,462)	[3,471]	{1,735}	72,516	(14,503)	[3,481]	{1,740}	72,713	(14,543)	[3,490]	{1,745}
Gunnison	1,368	1,369	1,370	1,371	1,374	(275)	[66]	{33}	1,378	(276)	[66]	{33}	1,381	(276)	[66]	{33}
Jefferson	48,351	48,410	48,452	48,497	48,559	(9,712)	[2,331]	{1,165}	48,616	(9,723)	[2,334]	{1,167}	48,670	(9,734)	[2,336]	{1,168}
Larimer	27,253	27,295	27,326	27,338	27,382	(5,476)	[1,314]	{657}	27,424	(5,485)	[1,316]	{658}	27,465	(5,493)	[1,318]	{659}
Pueblo	19,264	19,341	19,369	19,406	19,453	(3,891)	[934]	{467}	19,500	(3,900)	[936]	{468}	19,547	(3,909)	[938]	{469}
Weld	32,956	33,010	33,043	33,063	33,125	(6,625)	[1,590]	{795}	33,183	(6,637)	[1,593]	{796}	33,240	(6,648)	[1,596]	{798}

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.