

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

Date: 7/14/21

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 7/14/21 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.**

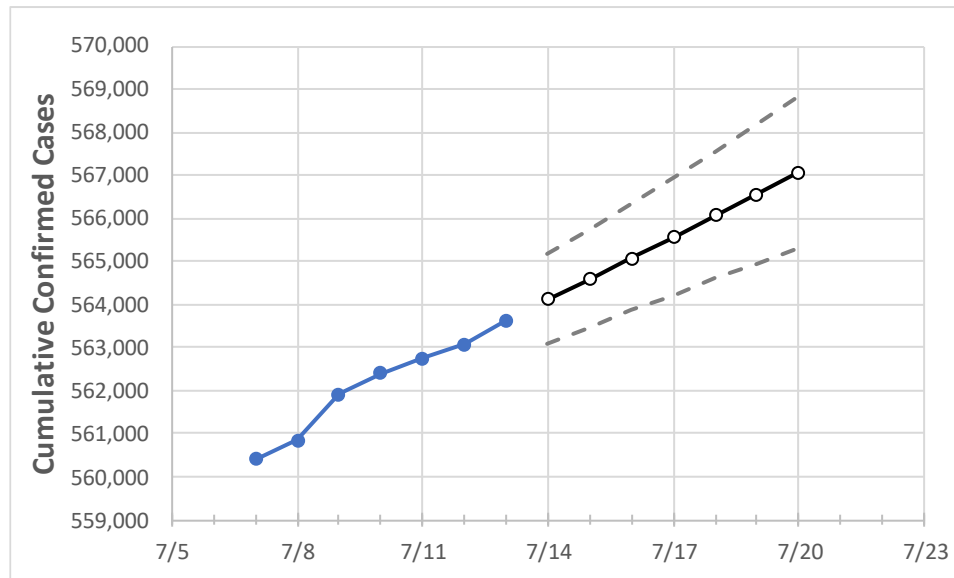
### IEM's Modeling Lead

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Colorado	562,401	562,763	563,086	563,642	564,114	564,590	565,076	565,569	566,060	566,556	567,065

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Adams	61,318	61,346	61,365	61,393	61,429	61,466	61,502	61,540	61,578	61,615	61,653
Arapahoe	63,204	63,257	63,290	63,333	63,377	63,422	63,467	63,511	63,555	63,602	63,646
Boulder	24,151	24,168	24,191	24,213	24,236	24,261	24,286	24,313	24,340	24,368	24,399
Denver	74,761	74,789	74,823	74,889	74,935	74,980	75,027	75,075	75,124	75,176	75,227
Douglas	30,767	30,789	30,800	30,835	30,863	30,891	30,919	30,948	30,977	31,008	31,037
Eagle	6,398	6,399	6,399	6,404	6,408	6,412	6,416	6,420	6,425	6,429	6,434
El Paso	74,110	74,171	74,223	74,353	74,429	74,505	74,581	74,660	74,736	74,813	74,890
Gunnison	1,407	1,408	1,408	1,407	1,408	1,410	1,411	1,412	1,413	1,415	1,416
Jefferson	49,209	49,226	49,246	49,280	49,310	49,341	49,372	49,403	49,435	49,467	49,500
Larimer	27,966	27,982	28,007	28,034	28,059	28,085	28,110	28,136	28,163	28,190	28,217
Pueblo	19,675	19,678	19,680	19,693	19,699	19,705	19,710	19,716	19,721	19,726	19,731
Weld	33,703	33,720	33,740	33,766	33,786	33,807	33,828	33,849	33,869	33,890	33,911

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:											
	7/10	7/11	7/12	7/13	7/15				7/17				7/19			
Adams	61,318	61,346	61,365	61,393	61,466	(12,293)	[2,950]	{1,475}	61,540	(12,308)	[2,954]	{1,477}	61,615	(12,323)	[2,958]	{1,479}
Arapahoe	63,204	63,257	63,290	63,333	63,422	(12,684)	[3,044]	{1,522}	63,511	(12,702)	[3,049]	{1,524}	63,602	(12,720)	[3,053]	{1,526}
Boulder	24,151	24,168	24,191	24,213	24,261	(4,852)	[1,165]	{582}	24,313	(4,863)	[1,167]	{584}	24,368	(4,874)	[1,170]	{585}
Denver	74,761	74,789	74,823	74,889	74,980	(14,996)	[3,599]	{1,800}	75,075	(15,015)	[3,604]	{1,802}	75,176	(15,035)	[3,608]	{1,804}
Douglas	30,767	30,789	30,800	30,835	30,891	(6,178)	[1,483]	{741}	30,948	(6,190)	[1,486]	{743}	31,008	(6,202)	[1,488]	{744}
Eagle	6,398	6,399	6,399	6,404	6,412	(1,282)	[308]	{154}	6,420	(1,284)	[308]	{154}	6,429	(1,286)	[309]	{154}
El Paso	74,110	74,171	74,223	74,353	74,505	(14,901)	[3,576]	{1,788}	74,660	(14,932)	[3,584]	{1,792}	74,813	(14,963)	[3,591]	{1,796}
Gunnison	1,407	1,408	1,408	1,407	1,410	(282)	[68]	{34}	1,412	(282)	[68]	{34}	1,415	(283)	[68]	{34}
Jefferson	49,209	49,226	49,246	49,280	49,341	(9,868)	[2,368]	{1,184}	49,403	(9,881)	[2,371]	{1,186}	49,467	(9,893)	[2,374]	{1,187}
Larimer	27,966	27,982	28,007	28,034	28,085	(5,617)	[1,348]	{674}	28,136	(5,627)	[1,351]	{675}	28,190	(5,638)	[1,353]	{677}
Pueblo	19,675	19,678	19,680	19,693	19,705	(3,941)	[946]	{473}	19,716	(3,943)	[946]	{473}	19,726	(3,945)	[947]	{473}
Weld	33,703	33,720	33,740	33,766	33,807	(6,761)	[1,623]	{811}	33,849	(6,770)	[1,625]	{812}	33,890	(6,778)	[1,627]	{813}

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.