

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

Date: 10/8/21

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 10/8/21 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.**

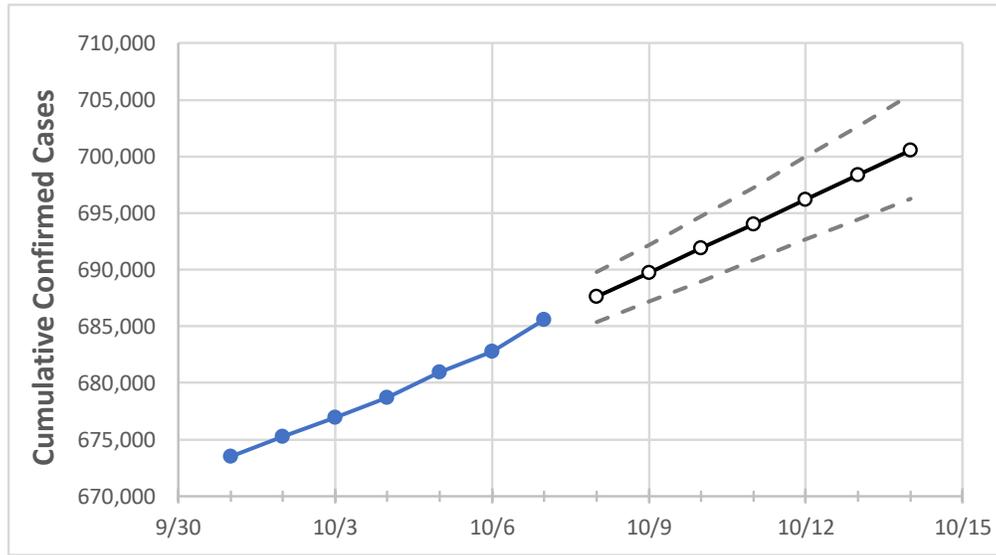
### IEM's Modeling Lead

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:					
	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14
Colorado	678,655	680,930	682,773	685,554	687,632	689,737	691,882	694,014	696,197	698,396	700,567

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:					
	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14
Adams	71,347	71,487	71,596	71,798	71,935	72,076	72,216	72,361	72,504	72,648	72,792
Arapahoe	74,589	74,789	74,922	75,197	75,369	75,537	75,712	75,889	76,067	76,249	76,428
Boulder	28,871	28,972	29,002	29,116	29,192	29,270	29,346	29,426	29,507	29,586	29,666
Denver	86,475	86,737	86,928	87,161	87,359	87,552	87,748	87,949	88,150	88,354	88,561
Douglas	37,681	37,817	37,897	38,040	38,152	38,263	38,374	38,486	38,601	38,718	38,833
Eagle	7,957	7,971	7,983	8,003	8,017	8,030	8,044	8,057	8,070	8,084	8,098
El Paso	93,030	93,412	93,711	94,170	94,515	94,868	95,221	95,572	95,931	96,302	96,668
Gunnison	1,756	1,759	1,762	1,772	1,776	1,780	1,784	1,787	1,791	1,795	1,798
Jefferson	58,795	58,998	59,122	59,301	59,457	59,614	59,767	59,923	60,081	60,240	60,397
Larimer	35,722	35,844	35,961	36,160	36,290	36,419	36,549	36,680	36,814	36,947	37,077
Pueblo	22,856	22,951	23,008	23,115	23,186	23,258	23,329	23,400	23,473	23,550	23,622
Weld	42,497	42,617	42,781	43,014	43,175	43,335	43,502	43,665	43,834	44,007	44,175

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:											
	10/4	10/5	10/6	10/7	10/9			10/11			10/13					
Adams	71,347	71,487	71,596	71,798	72,076	(14,415)	[3,460]	{1,730}	72,361	(14,472)	[3,473]	{1,737}	72,648	(14,530)	[3,487]	{1,744}
Arapahoe	74,589	74,789	74,922	75,197	75,537	(15,107)	[3,626]	{1,813}	75,889	(15,178)	[3,643]	{1,821}	76,249	(15,250)	[3,660]	{1,830}
Boulder	28,871	28,972	29,002	29,116	29,270	(5,854)	[1,405]	{702}	29,426	(5,885)	[1,412]	{706}	29,586	(5,917)	[1,420]	{710}
Denver	86,475	86,737	86,928	87,161	87,552	(17,510)	[4,203]	{2,101}	87,949	(17,590)	[4,222]	{2,111}	88,354	(17,671)	[4,241]	{2,121}
Douglas	37,681	37,817	37,897	38,040	38,263	(7,653)	[1,837]	{918}	38,486	(7,697)	[1,847]	{924}	38,718	(7,744)	[1,858]	{929}
Eagle	7,957	7,971	7,983	8,003	8,030	(1,606)	[385]	{193}	8,057	(1,611)	[387]	{193}	8,084	(1,617)	[388]	{194}
El Paso	93,030	93,412	93,711	94,170	94,868	(18,974)	[4,554]	{2,277}	95,572	(19,114)	[4,587]	{2,294}	96,302	(19,260)	[4,623]	{2,311}
Gunnison	1,756	1,759	1,762	1,772	1,780	(356)	[85]	{43}	1,787	(357)	[86]	{43}	1,795	(359)	[86]	{43}
Jefferson	58,795	58,998	59,122	59,301	59,614	(11,923)	[2,861]	{1,431}	59,923	(11,985)	[2,876]	{1,438}	60,240	(12,048)	[2,892]	{1,446}
Larimer	35,722	35,844	35,961	36,160	36,419	(7,284)	[1,748]	{874}	36,680	(7,336)	[1,761]	{880}	36,947	(7,389)	[1,773]	{887}
Pueblo	22,856	22,951	23,008	23,115	23,258	(4,652)	[1,116]	{558}	23,400	(4,680)	[1,123]	{562}	23,550	(4,710)	[1,130]	{565}
Weld	42,497	42,617	42,781	43,014	43,335	(8,667)	[2,080]	{1,040}	43,665	(8,733)	[2,096]	{1,048}	44,007	(8,801)	[2,112]	{1,056}

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.