

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

Date: 1/25/21

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 1/25/21 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.**

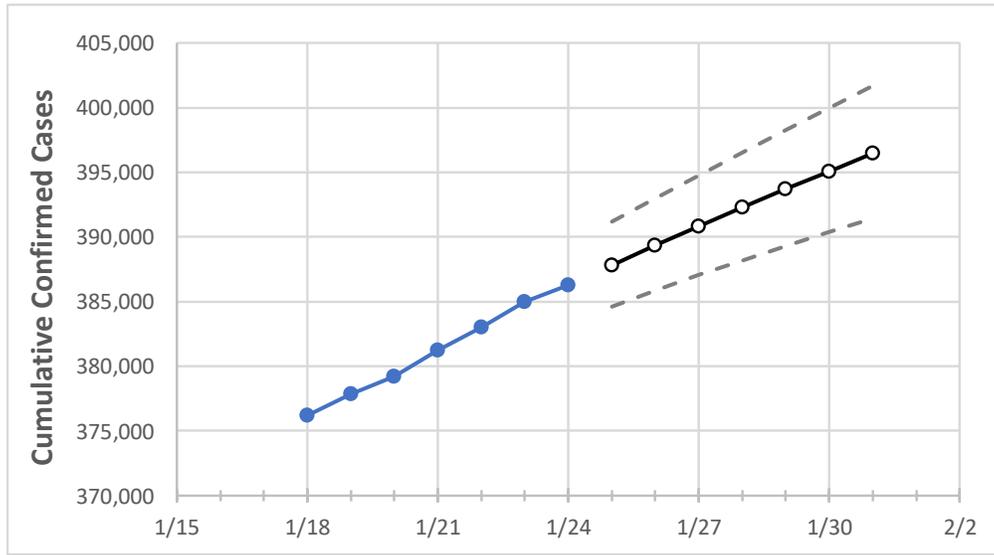
### IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Colorado	381,210	383,008	384,966	386,285	387,837	389,353	390,825	392,277	393,700	395,077	396,452

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Adams	44,442	44,580	44,752	44,877	45,007	45,131	45,252	45,371	45,489	45,603	45,717
Arapahoe	43,287	43,498	43,735	43,906	44,083	44,258	44,427	44,591	44,756	44,920	45,077
Boulder	16,514	16,595	16,683	16,742	16,808	16,871	16,932	16,992	17,052	17,109	17,167
Denver	53,998	54,162	54,371	54,528	54,693	54,855	55,016	55,166	55,313	55,457	55,599
Douglas	18,096	18,187	18,297	18,374	18,460	18,544	18,625	18,703	18,783	18,862	18,939
Eagle	4,121	4,147	4,172	4,192	4,230	4,266	4,303	4,340	4,377	4,415	4,453
El Paso	46,330	46,518	46,680	46,818	46,972	47,121	47,265	47,408	47,552	47,692	47,822
Gunnison	949	962	975	987	1,005	1,023	1,041	1,061	1,081	1,103	1,125
Jefferson	33,321	33,489	33,640	33,760	33,887	34,012	34,134	34,258	34,374	34,489	34,604
Larimer	17,259	17,331	17,454	17,517	17,608	17,697	17,784	17,871	17,958	18,042	18,125
Pueblo	14,113	14,131	14,159	14,177	14,195	14,213	14,230	14,247	14,263	14,278	14,293
Weld	22,832	22,948	23,033	23,106	23,197	23,285	23,371	23,452	23,533	23,613	23,689

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:											
	1/21	1/22	1/23	1/24	1/26				1/28				1/30			
Adams	44,442	44,580	44,752	44,877	45,131	(9,026)	[2,166]	{1,083}	45,371	(9,074)	[2,178]	{1,089}	45,603	(9,121)	[2,189]	{1,094}
Arapahoe	43,287	43,498	43,735	43,906	44,258	(8,852)	[2,124]	{1,062}	44,591	(8,918)	[2,140]	{1,070}	44,920	(8,984)	[2,156]	{1,078}
Boulder	16,514	16,595	16,683	16,742	16,871	(3,374)	[810]	{405}	16,992	(3,398)	[816]	{408}	17,109	(3,422)	[821]	{411}
Denver	53,998	54,162	54,371	54,528	54,855	(10,971)	[2,633]	{1,317}	55,166	(11,033)	[2,648]	{1,324}	55,457	(11,091)	[2,662]	{1,331}
Douglas	18,096	18,187	18,297	18,374	18,544	(3,709)	[890]	{445}	18,703	(3,741)	[898]	{449}	18,862	(3,772)	[905]	{453}
Eagle	4,121	4,147	4,172	4,192	4,266	(853)	[205]	{102}	4,340	(868)	[208]	{104}	4,415	(883)	[212]	{106}
El Paso	46,330	46,518	46,680	46,818	47,121	(9,424)	[2,262]	{1,131}	47,408	(9,482)	[2,276]	{1,138}	47,692	(9,538)	[2,289]	{1,145}
Gunnison	949	962	975	987	1,023	(205)	[49]	{25}	1,061	(212)	[51]	{25}	1,103	(221)	[53]	{26}
Jefferson	33,321	33,489	33,640	33,760	34,012	(6,802)	[1,633]	{816}	34,258	(6,852)	[1,644]	{822}	34,489	(6,898)	[1,655]	{828}
Larimer	17,259	17,331	17,454	17,517	17,697	(3,539)	[849]	{425}	17,871	(3,574)	[858]	{429}	18,042	(3,608)	[866]	{433}
Pueblo	14,113	14,131	14,159	14,177	14,213	(2,843)	[682]	{341}	14,247	(2,849)	[684]	{342}	14,278	(2,856)	[685]	{343}
Weld	22,832	22,948	23,033	23,106	23,285	(4,657)	[1,118]	{559}	23,452	(4,690)	[1,126]	{563}	23,613	(4,723)	[1,133]	{567}

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.