

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 3/11/22**

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 3/11/22 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.

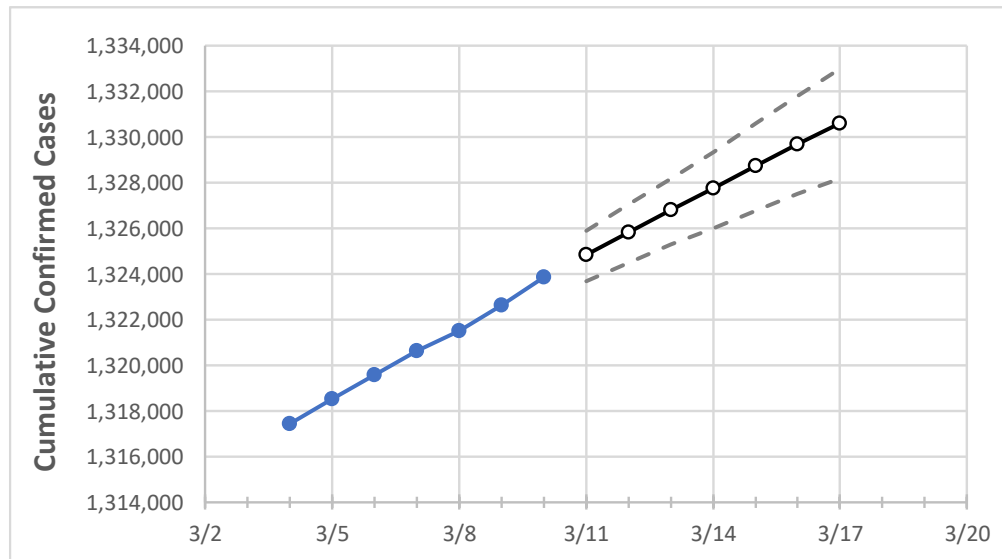
IEM's Modeling Lead

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Colorado	1,320,644	1,321,502	1,322,637	1,323,874	1,324,856	1,325,835	1,326,805	1,327,769	1,328,732	1,329,682	1,330,592

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Adams	129,091	129,150	129,234	129,317	129,371	129,419	129,469	129,519	129,564	129,613	129,657
Arapahoe	147,171	147,235	147,333	147,445	147,508	147,569	147,631	147,688	147,745	147,799	147,850
Boulder	61,073	61,102	61,168	61,258	61,305	61,351	61,397	61,441	61,486	61,530	61,571
Denver	165,157	165,227	165,360	165,532	165,613	165,692	165,769	165,846	165,921	165,993	166,064
Douglas	75,602	75,651	75,702	75,761	75,799	75,836	75,871	75,906	75,939	75,975	76,006
Eagle	15,692	15,693	15,699	15,707	15,714	15,720	15,725	15,731	15,737	15,743	15,748
El Paso	179,870	180,025	180,143	180,295	180,422	180,553	180,675	180,799	180,921	181,040	181,150
Gunnison	3,292	3,296	3,298	3,300	3,305	3,309	3,313	3,318	3,323	3,327	3,332
Jefferson	118,645	118,750	118,905	119,005	119,084	119,158	119,232	119,304	119,374	119,443	119,510
Larimer	74,296	74,332	74,402	74,498	74,561	74,620	74,679	74,736	74,792	74,845	74,900
Pueblo	44,361	44,459	44,523	44,609	44,658	44,705	44,751	44,798	44,846	44,890	44,936
Weld	80,853	80,895	80,942	81,025	81,072	81,121	81,168	81,213	81,258	81,301	81,345

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:											
	3/7	3/8	3/9	3/10	3/12				3/14				3/16			
Adams	129,091	129,150	129,234	129,317	129,419	(25,884)	[6,212]	{3,106}	129,519	(25,904)	[6,217]	{3,108}	129,613	(25,923)	[6,221]	{3,111}
Arapahoe	147,171	147,235	147,333	147,445	147,569	(29,514)	[7,083]	{3,542}	147,688	(29,538)	[7,089]	{3,545}	147,799	(29,560)	[7,094]	{3,547}
Boulder	61,073	61,102	61,168	61,258	61,351	(12,270)	[2,945]	{1,472}	61,441	(12,288)	[2,949]	{1,475}	61,530	(12,306)	[2,953]	{1,477}
Denver	165,157	165,227	165,360	165,532	165,692	(33,138)	[7,953]	{3,977}	165,846	(33,169)	[7,961]	{3,980}	165,993	(33,199)	[7,968]	{3,984}
Douglas	75,602	75,651	75,702	75,761	75,836	(15,167)	[3,640]	{1,820}	75,906	(15,181)	[3,643]	{1,822}	75,975	(15,195)	[3,647]	{1,823}
Eagle	15,692	15,693	15,699	15,707	15,720	(3,144)	[755]	{377}	15,731	(3,146)	[755]	{378}	15,743	(3,149)	[756]	{378}
El Paso	179,870	180,025	180,143	180,295	180,553	(36,111)	[8,667]	{4,333}	180,799	(36,160)	[8,678]	{4,339}	181,040	(36,208)	[8,690]	{4,345}
Gunnison	3,292	3,296	3,298	3,300	3,309	(662)	[159]	{79}	3,318	(664)	[159]	{80}	3,327	(665)	[160]	{80}
Jefferson	118,645	118,750	118,905	119,005	119,158	(23,832)	[5,720]	{2,860}	119,304	(23,861)	[5,727]	{2,863}	119,443	(23,889)	[5,733]	{2,867}
Larimer	74,296	74,332	74,402	74,498	74,620	(14,924)	[3,582]	{1,791}	74,736	(14,947)	[3,587]	{1,794}	74,845	(14,969)	[3,593]	{1,796}
Pueblo	44,361	44,459	44,523	44,609	44,705	(8,941)	[2,146]	{1,073}	44,798	(8,960)	[2,150]	{1,075}	44,890	(8,978)	[2,155]	{1,077}
Weld	80,853	80,895	80,942	81,025	81,121	(16,224)	[3,894]	{1,947}	81,213	(16,243)	[3,898]	{1,949}	81,301	(16,260)	[3,902]	{1,951}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.