

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

Date: 3/4/22

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 3/4/22 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.

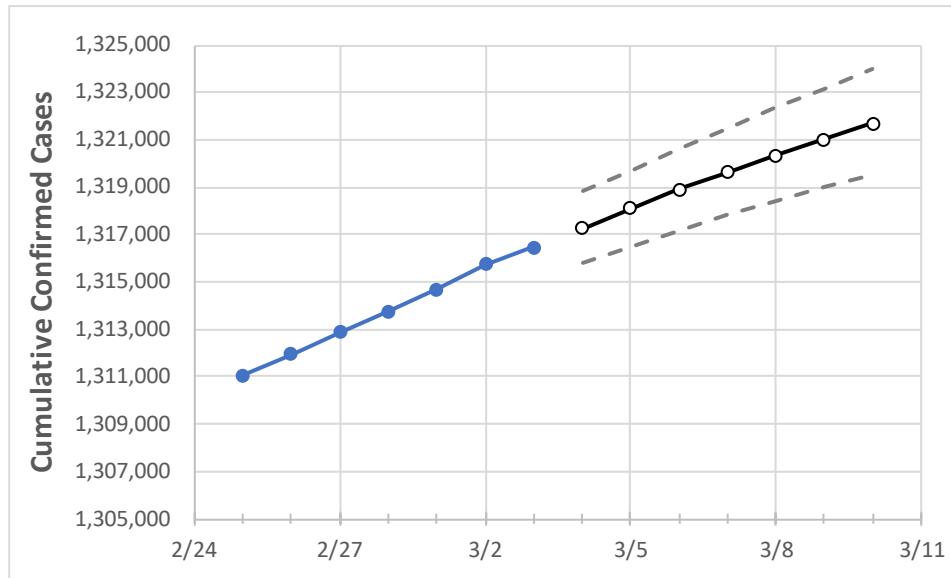
IEM's Modeling Lead

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:							
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	
Colorado	1,313,779	1,314,678	1,315,727	1,316,450	1,317,285	1,318,097	1,318,894	1,319,645	1,320,331	1,321,034	1,321,697	

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:							
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	
Adams	128,660	128,725	128,800	128,865	128,917	128,967	129,014	129,059	129,104	129,145	129,186	
Arapahoe	146,766	146,841	146,931	146,943	147,030	147,114	147,194	147,271	147,347	147,419	147,489	
Boulder	60,727	60,768	60,824	60,886	60,930	60,974	61,010	61,051	61,087	61,126	61,161	
Denver	164,575	164,683	164,792	164,817	164,907	164,994	165,079	165,158	165,239	165,312	165,383	
Douglas	75,337	75,381	75,424	75,453	75,505	75,553	75,601	75,647	75,692	75,735	75,778	
Eagle	15,618	15,625	15,632	15,635	15,641	15,647	15,652	15,657	15,661	15,666	15,671	
El Paso	178,781	178,907	179,033	179,169	179,292	179,409	179,521	179,625	179,731	179,829	179,927	
Gunnison	3,262	3,270	3,272	3,272	3,281	3,289	3,299	3,308	3,318	3,328	3,337	
Jefferson	118,103	118,193	118,298	118,346	118,438	118,525	118,612	118,695	118,770	118,854	118,925	
Larimer	73,769	73,856	73,931	74,011	74,084	74,154	74,224	74,289	74,353	74,416	74,474	
Pueblo	43,991	44,036	44,067	44,155	44,186	44,212	44,240	44,268	44,295	44,321	44,342	
Weld	80,455	80,491	80,568	80,611	80,660	80,709	80,755	80,801	80,841	80,887	80,924	

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:											
	2/28	3/1	3/2	3/3	3/5				3/7				3/9			
Adams	128,660	128,725	128,800	128,865	128,967	(25,793)	[6,190]	{3,095}	129,059	(25,812)	[6,195]	{3,097}	129,145	(25,829)	[6,199]	{3,099}
Arapahoe	146,766	146,841	146,931	146,943	147,114	(29,423)	[7,061]	{3,531}	147,271	(29,454)	[7,069]	{3,535}	147,419	(29,484)	[7,076]	{3,538}
Boulder	60,727	60,768	60,824	60,886	60,974	(12,195)	[2,927]	{1,463}	61,051	(12,210)	[2,930]	{1,465}	61,126	(12,225)	[2,934]	{1,467}
Denver	164,575	164,683	164,792	164,817	164,994	(32,999)	[7,920]	{3,960}	165,158	(33,032)	[7,928]	{3,964}	165,312	(33,062)	[7,935]	{3,967}
Douglas	75,337	75,381	75,424	75,453	75,553	(15,111)	[3,627]	{1,813}	75,647	(15,129)	[3,631]	{1,816}	75,735	(15,147)	[3,635]	{1,818}
Eagle	15,618	15,625	15,632	15,635	15,647	(3,129)	[751]	{376}	15,657	(3,131)	[752]	{376}	15,666	(3,133)	[752]	{376}
El Paso	178,781	178,907	179,033	179,169	179,409	(35,882)	[8,612]	{4,306}	179,625	(35,925)	[8,622]	{4,311}	179,829	(35,966)	[8,632]	{4,316}
Gunnison	3,262	3,270	3,272	3,272	3,289	(658)	[158]	{79}	3,308	(662)	[159]	{79}	3,328	(666)	[160]	{80}
Jefferson	118,103	118,193	118,298	118,346	118,525	(23,705)	[5,689]	{2,845}	118,695	(23,739)	[5,697]	{2,849}	118,854	(23,771)	[5,705]	{2,852}
Larimer	73,769	73,856	73,931	74,011	74,154	(14,831)	[3,559]	{1,780}	74,289	(14,858)	[3,566]	{1,783}	74,416	(14,883)	[3,572]	{1,786}
Pueblo	43,991	44,036	44,067	44,155	44,212	(8,842)	[2,122]	{1,061}	44,268	(8,854)	[2,125]	{1,062}	44,321	(8,864)	[2,127]	{1,064}
Weld	80,455	80,491	80,568	80,611	80,709	(16,142)	[3,874]	{1,937}	80,801	(16,160)	[3,878]	{1,939}	80,887	(16,177)	[3,883]	{1,941}

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.