

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

Date: 1/28/21

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 1/28/21 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.

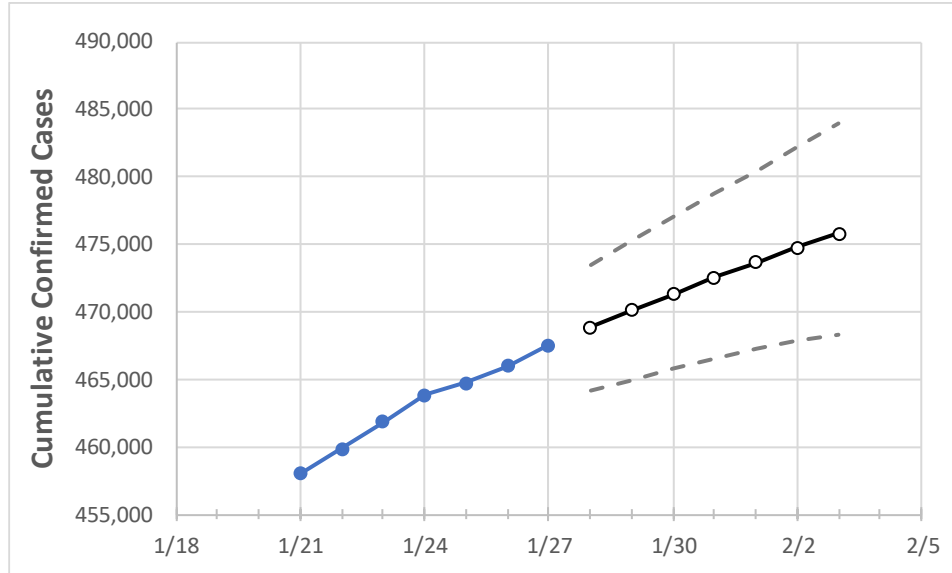
IEM's Modeling Lead

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.

Missouri State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Missouri	463,856	464,686	465,984	467,531	468,843	470,118	471,321	472,525	473,648	474,764	475,824

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.

Missouri Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Boone	15,026	15,037	15,062	15,136	15,177	15,216	15,251	15,289	15,324	15,358	15,392
City of St. Louis	19,931	19,942	19,947	20,009	20,052	20,093	20,131	20,167	20,200	20,232	20,262
Greene	21,871	21,921	21,973	22,076	22,138	22,197	22,254	22,307	22,358	22,407	22,454
Jackson (& KC)	62,327	62,442	62,639	62,837	63,062	63,277	63,492	63,697	63,904	64,107	64,301
St. Charles	31,019	31,084	31,147	31,215	31,295	31,368	31,441	31,510	31,574	31,638	31,699
St. Louis	81,147	81,279	81,758	82,071	82,380	82,676	82,970	83,239	83,517	83,779	84,040

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.

Missouri Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Boone	15,026	15,037	15,062	15,136	15,216	(3,043)	[730]	{365}	15,289	(3,058)	[734]	{367}	15,358	(3,072)	[737]	{369}
City of St. Louis	19,931	19,942	19,947	20,009	20,093	(4,019)	[964]	{482}	20,167	(4,033)	[968]	{484}	20,232	(4,046)	[971]	{486}
Greene	21,871	21,921	21,973	22,076	22,197	(4,439)	[1,065]	{533}	22,307	(4,461)	[1,071]	{535}	22,407	(4,481)	[1,076]	{538}
Jackson (& KC)	62,327	62,442	62,639	62,837	63,277	(12,655)	[3,037]	{1,519}	63,697	(12,739)	[3,057]	{1,529}	64,107	(12,821)	[3,077]	{1,539}
St. Charles	31,019	31,084	31,147	31,215	31,368	(6,274)	[1,506]	{753}	31,510	(6,302)	[1,512]	{756}	31,638	(6,328)	[1,519]	{759}
St. Louis	81,147	81,279	81,758	82,071	82,676	(16,535)	[3,968]	{1,984}	83,239	(16,648)	[3,995]	{1,998}	83,779	(16,756)	[4,021]	{2,011}

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.