

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

Date: 2/24/21

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 2/24/21 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.

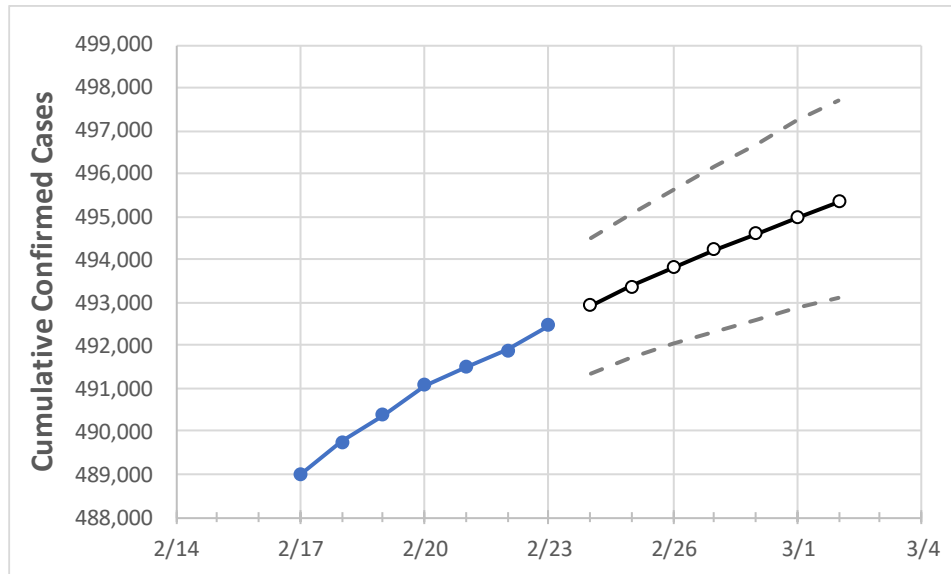
IEM's Modeling Lead

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Missouri	491,070	491,489	491,902	492,477	492,944	493,386	493,818	494,226	494,612	494,987	495,340

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Boone	15,810	15,824	15,833	15,842	15,855	15,867	15,879	15,891	15,902	15,913	15,922
City of St. Louis	21,208	21,236	21,263	21,283	21,313	21,341	21,369	21,396	21,421	21,445	21,470
Greene	23,197	23,220	23,251	23,271	23,292	23,312	23,331	23,350	23,367	23,384	23,400
Jackson (& KC)	66,369	66,427	66,458	66,544	66,609	66,672	66,738	66,795	66,852	66,910	66,963
St. Charles	32,668	32,702	32,732	32,759	32,798	32,837	32,875	32,910	32,945	32,977	33,012
St. Louis	87,345	87,465	87,557	87,744	87,865	87,979	88,087	88,193	88,299	88,399	88,494

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:											
	2/20	2/21	2/22	2/23	2/25				2/27				3/1			
Boone	15,810	15,824	15,833	15,842	15,867	(3,173)	[762]	{381}	15,891	(3,178)	[763]	{381}	15,913	(3,183)	[764]	{382}
City of St. Louis	21,208	21,236	21,263	21,283	21,341	(4,268)	[1,024]	{512}	21,396	(4,279)	[1,027]	{513}	21,445	(4,289)	[1,029]	{515}
Greene	23,197	23,220	23,251	23,271	23,312	(4,662)	[1,119]	{559}	23,350	(4,670)	[1,121]	{560}	23,384	(4,677)	[1,122]	{561}
Jackson (& KC)	66,369	66,427	66,458	66,544	66,672	(13,334)	[3,200]	{1,600}	66,795	(13,359)	[3,206]	{1,603}	66,910	(13,382)	[3,212]	{1,606}
St. Charles	32,668	32,702	32,732	32,759	32,837	(6,567)	[1,576]	{788}	32,910	(6,582)	[1,580]	{790}	32,977	(6,595)	[1,583]	{791}
St. Louis	87,345	87,465	87,557	87,744	87,979	(17,596)	[4,223]	{2,111}	88,193	(17,639)	[4,233]	{2,117}	88,399	(17,680)	[4,243]	{2,122}

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.