

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/22/21**

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 1/22/21 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.

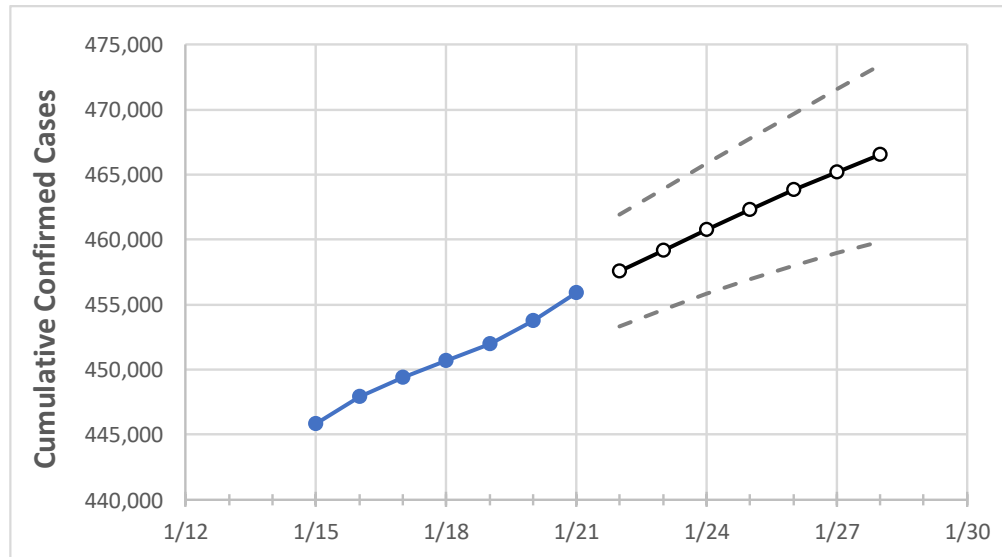
IEM's Modeling Lead

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Missouri	450,694	451,986	453,777	455,889	457,574	459,175	460,781	462,298	463,804	465,203	466,547

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Boone	14,678	14,698	14,773	14,839	14,894	14,948	15,001	15,054	15,102	15,153	15,203
City of St. Louis	17,487	17,569	17,632	17,679	17,694	17,708	17,722	17,735	17,747	17,758	17,770
Greene	21,363	21,443	21,511	21,606	21,691	21,776	21,857	21,934	22,007	22,077	22,146
Jackson (& KC)	60,466	60,660	60,943	61,193	61,448	61,696	61,936	62,165	62,391	62,610	62,816
St. Charles	30,273	30,391	30,515	30,679	30,802	30,918	31,029	31,136	31,242	31,345	31,447
St. Louis	78,781	79,030	79,512	79,875	80,287	80,686	81,071	81,454	81,827	82,198	82,570

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:											
	1/18	1/19	1/20	1/21	1/23				1/25				1/27			
Boone	14,678	14,698	14,773	14,839	14,948	(2,990)	[717]	{359}	15,054	(3,011)	[723]	{361}	15,153	(3,031)	[727]	{364}
City of St. Louis	17,487	17,569	17,632	17,679	17,708	(3,542)	[850]	{425}	17,735	(3,547)	[851]	{426}	17,758	(3,552)	[852]	{426}
Greene	21,363	21,443	21,511	21,606	21,776	(4,355)	[1,045]	{523}	21,934	(4,387)	[1,053]	{526}	22,077	(4,415)	[1,060]	{530}
Jackson (& KC)	60,466	60,660	60,943	61,193	61,696	(12,339)	[2,961]	{1,481}	62,165	(12,433)	[2,984]	{1,492}	62,610	(12,522)	[3,005]	{1,503}
St. Charles	30,273	30,391	30,515	30,679	30,918	(6,184)	[1,484]	{742}	31,136	(6,227)	[1,495]	{747}	31,345	(6,269)	[1,505]	{752}
St. Louis	78,781	79,030	79,512	79,875	80,686	(16,137)	[3,873]	{1,936}	81,454	(16,291)	[3,910]	{1,955}	82,198	(16,440)	[3,946]	{1,973}

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.