

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

Date: 2/8/21

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 2/8/21 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.

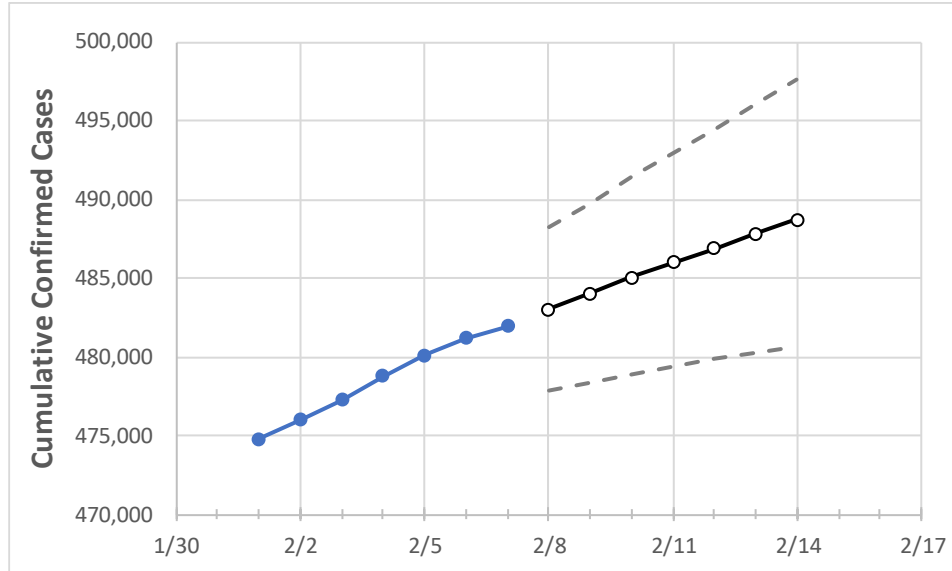
IEM's Modeling Lead

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Missouri	478,750	480,086	481,183	481,929	482,991	484,012	485,027	485,999	486,910	487,831	488,717

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Boone	15,452	15,509	15,553	15,585	15,619	15,652	15,685	15,718	15,750	15,781	15,811
City of St. Louis	20,540	20,594	20,669	20,701	20,761	20,820	20,878	20,938	20,999	21,059	21,117
Greene	22,590	22,630	22,692	22,746	22,797	22,847	22,895	22,941	22,990	23,035	23,079
Jackson (& KC)	64,670	64,805	64,931	65,062	65,204	65,344	65,476	65,599	65,726	65,850	65,972
St. Charles	31,773	31,847	31,908	31,941	31,991	32,039	32,083	32,127	32,170	32,211	32,252
St. Louis	84,532	84,861	85,062	85,160	85,378	85,582	85,782	85,970	86,157	86,342	86,514

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:											
	2/4	2/5	2/6	2/7	2/9				2/11				2/13			
Boone	15,452	15,509	15,553	15,585	15,652	(3,130)	[751]	{376}	15,718	(3,144)	[754]	{377}	15,781	(3,156)	[757]	{379}
City of St. Louis	20,540	20,594	20,669	20,701	20,820	(4,164)	[999]	{500}	20,938	(4,188)	[1,005]	{503}	21,059	(4,212)	[1,011]	{505}
Greene	22,590	22,630	22,692	22,746	22,847	(4,569)	[1,097]	{548}	22,941	(4,588)	[1,101]	{551}	23,035	(4,607)	[1,106]	{553}
Jackson (& KC)	64,670	64,805	64,931	65,062	65,344	(13,069)	[3,137]	{1,568}	65,599	(13,120)	[3,149]	{1,574}	65,850	(13,170)	[3,161]	{1,580}
St. Charles	31,773	31,847	31,908	31,941	32,039	(6,408)	[1,538]	{769}	32,127	(6,425)	[1,542]	{771}	32,211	(6,442)	[1,546]	{773}
St. Louis	84,532	84,861	85,062	85,160	85,582	(17,116)	[4,108]	{2,054}	85,970	(17,194)	[4,127]	{2,063}	86,342	(17,268)	[4,144]	{2,072}

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.