

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

Date: 4/16/21

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 4/16/21 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.

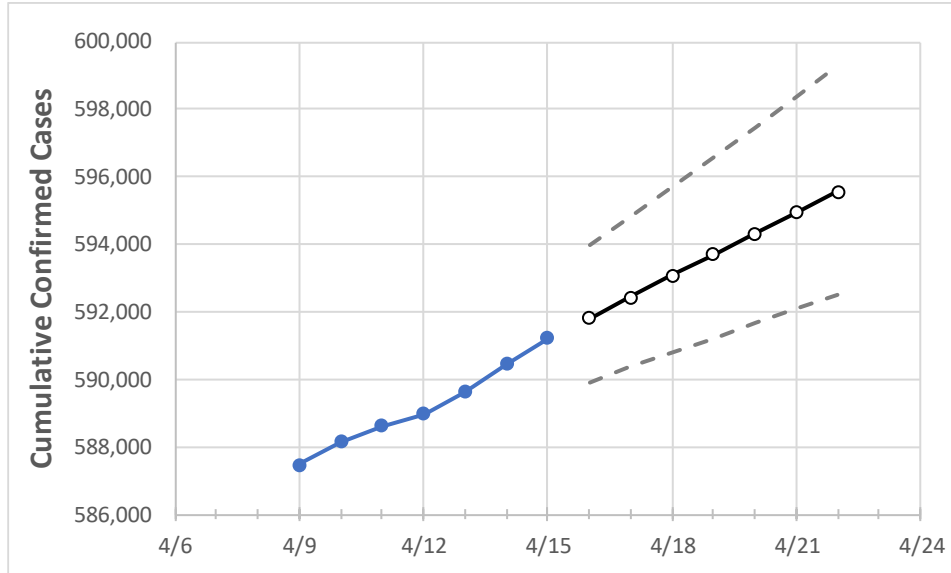
IEM's Modeling Lead

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Missouri	588,962	589,626	590,452	591,207	591,814	592,442	593,072	593,692	594,310	594,935	595,561	

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Boone	17,712	17,722	17,740	17,759	17,773	17,787	17,801	17,816	17,831	17,845	17,861	
City of St. Louis	23,093	23,132	23,197	23,197	23,247	23,298	23,351	23,405	23,460	23,516	23,574	
Greene	27,896	27,921	27,949	27,975	27,994	28,012	28,030	28,049	28,068	28,087	28,107	
Jackson (& KC)	80,678	80,770	80,856	80,989	81,074	81,162	81,251	81,341	81,432	81,523	81,616	
St. Charles	41,988	42,050	42,139	42,223	42,293	42,363	42,433	42,504	42,575	42,643	42,714	
St. Louis	94,605	94,780	95,006	95,172	95,341	95,516	95,691	95,869	96,044	96,224	96,407	

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:											
	4/12	4/13	4/14	4/15	4/17				4/19				4/21			
Boone	17,712	17,722	17,740	17,759	17,787	(3,557)	[854]	{427}	17,816	(3,563)	[855]	{428}	17,845	(3,569)	[857]	{428}
City of St. Louis	23,093	23,132	23,197	23,197	23,298	(4,660)	[1,118]	{559}	23,405	(4,681)	[1,123]	{562}	23,516	(4,703)	[1,129]	{564}
Greene	27,896	27,921	27,949	27,975	28,012	(5,602)	[1,345]	{672}	28,049	(5,610)	[1,346]	{673}	28,087	(5,617)	[1,348]	{674}
Jackson (& KC)	80,678	80,770	80,856	80,989	81,162	(16,232)	[3,896]	{1,948}	81,341	(16,268)	[3,904]	{1,952}	81,523	(16,305)	[3,913]	{1,957}
St. Charles	41,988	42,050	42,139	42,223	42,363	(8,473)	[2,033]	{1,017}	42,504	(8,501)	[2,040]	{1,020}	42,643	(8,529)	[2,047]	{1,023}
St. Louis	94,605	94,780	95,006	95,172	95,516	(19,103)	[4,585]	{2,292}	95,869	(19,174)	[4,602]	{2,301}	96,224	(19,245)	[4,619]	{2,309}

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.