

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

Date: 12/14/20

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 12/14/20 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.

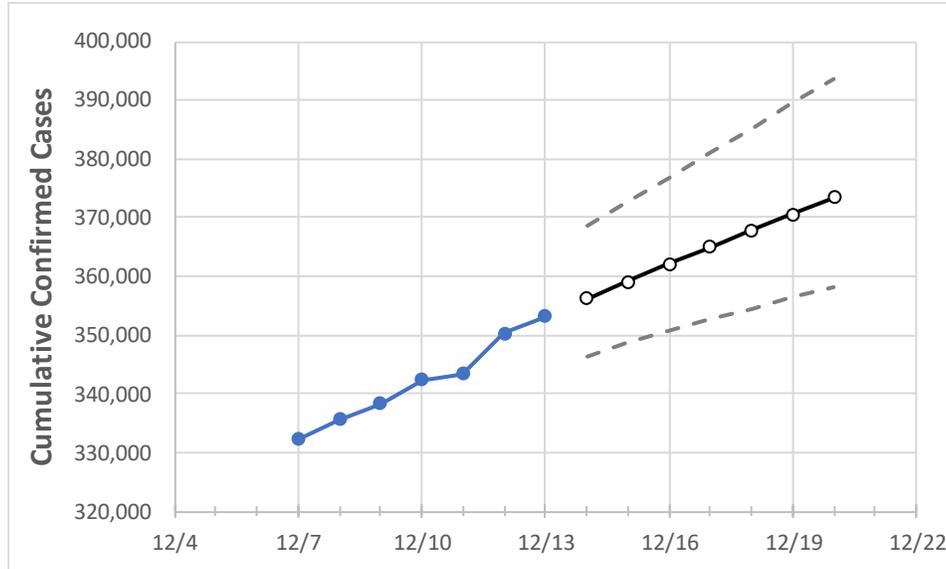
IEM's Modeling Lead

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:							
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	
Missouri	342,418	343,412	350,388	353,178	356,173	359,135	362,065	364,964	367,831	370,666	373,471	

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 20%, and are often within 10%, of actual confirmed cases.

Missouri Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	
Boone	11,450	11,567	11,683	11,776	11,867	11,959	12,052	12,145	12,239	12,334	12,429	
City of St. Louis	14,472	14,602	14,797	14,974	15,113	15,252	15,392	15,532	15,673	15,813	15,954	
Greene	15,647	15,874	16,101	16,211	16,384	16,558	16,734	16,912	17,091	17,272	17,455	
Jackson (& KC)	45,767	45,907	46,761	47,045	47,424	47,799	48,170	48,538	48,902	49,263	49,620	
St. Charles	22,809	23,075	23,340	23,619	23,857	24,093	24,328	24,562	24,794	25,025	25,255	
St. Louis	58,197	58,921	59,470	60,065	60,641	61,212	61,779	62,341	62,899	63,452	64,001	

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:											
	12/10	12/11	12/12	12/13	12/15				12/17				12/19			
Boone	11,450	11,567	11,683	11,776	11,959	(2,392)	[574]	{287}	12,145	(2,429)	[583]	{291}	12,334	(2,467)	[592]	{296}
City of St. Louis	14,472	14,602	14,797	14,974	15,252	(3,050)	[732]	{366}	15,532	(3,106)	[746]	{373}	15,813	(3,163)	[759]	{380}
Greene	15,647	15,874	16,101	16,211	16,558	(3,312)	[795]	{397}	16,912	(3,382)	[812]	{406}	17,272	(3,454)	[829]	{415}
Jackson (& KC)	45,767	45,907	46,761	47,045	47,799	(9,560)	[2,294]	{1,147}	48,538	(9,708)	[2,330]	{1,165}	49,263	(9,853)	[2,365]	{1,182}
St. Charles	22,809	23,075	23,340	23,619	24,093	(4,819)	[1,156]	{578}	24,562	(4,912)	[1,179]	{589}	25,025	(5,005)	[1,201]	{601}
St. Louis	58,197	58,921	59,470	60,065	61,212	(12,242)	[2,938]	{1,469}	62,341	(12,468)	[2,992]	{1,496}	63,452	(12,690)	[3,046]	{1,523}

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.