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

Date: 12/13/21

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 12/13/21 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.

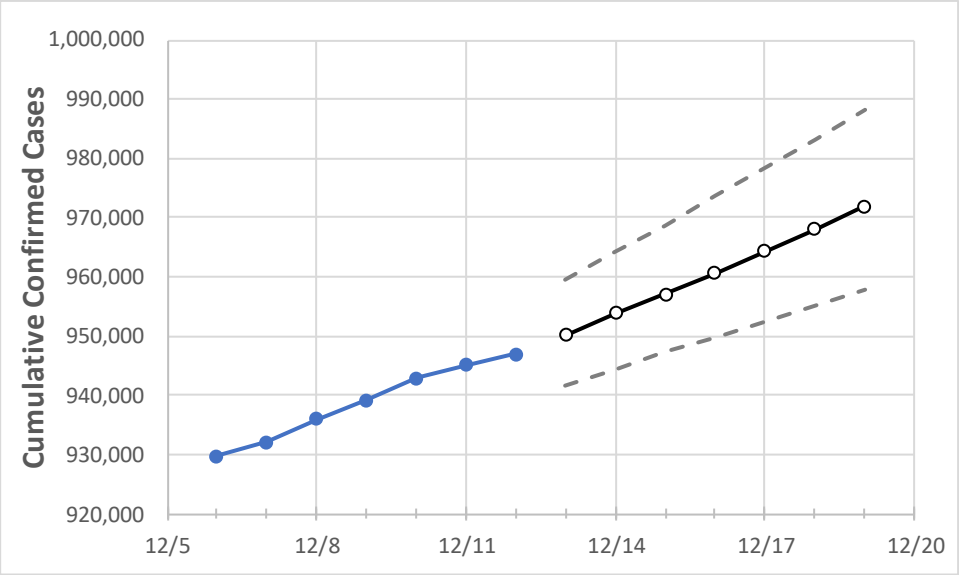
IEM's Modeling Lead

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Missouri	939,245	942,871	945,163	946,931	950,217	953,797	957,054	960,636	964,420	968,091	971,949

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Boone	26,883	26,947	27,014	27,067	27,138	27,211	27,285	27,361	27,438	27,517	27,599
City of St. Louis	35,096	35,191	35,257	35,308	35,395	35,484	35,576	35,672	35,766	35,865	35,965
Greene	46,415	46,532	46,618	46,695	46,820	46,944	47,072	47,205	47,342	47,484	47,623
Jackson (& KC)	131,487	132,097	132,514	132,949	133,533	134,121	134,718	135,331	135,962	136,611	137,324
St. Charles	61,095	61,346	61,526	61,714	61,925	62,150	62,374	62,601	62,845	63,089	63,340
St. Louis	139,111	139,825	139,988	139,988	140,401	140,815	141,229	141,673	142,124	142,589	143,050

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:											
	12/9	12/10	12/11	12/12	12/14				12/16				12/18			
Boone	26,883	26,947	27,014	27,067	27,211	(5,442)	[1,306]	{653}	27,361	(5,472)	[1,313]	{657}	27,517	(5,503)	[1,321]	{660}
City of St. Louis	35,096	35,191	35,257	35,308	35,484	(7,097)	[1,703]	{852}	35,672	(7,134)	[1,712]	{856}	35,865	(7,173)	[1,722]	{861}
Greene	46,415	46,532	46,618	46,695	46,944	(9,389)	[2,253]	{1,127}	47,205	(9,441)	[2,266]	{1,133}	47,484	(9,497)	[2,279]	{1,140}
Jackson (& KC)	131,487	132,097	132,514	132,949	134,121	(26,824)	[6,438]	{3,219}	135,331	(27,066)	[6,496]	{3,248}	136,611	(27,322)	[6,557]	{3,279}
St. Charles	61,095	61,346	61,526	61,714	62,150	(12,430)	[2,983]	{1,492}	62,601	(12,520)	[3,005]	{1,502}	63,089	(12,618)	[3,028]	{1,514}
St. Louis	139,111	139,825	139,988	139,988	140,815	(28,163)	[6,759]	{3,380}	141,673	(28,335)	[6,800]	{3,400}	142,589	(28,518)	[6,844]	{3,422}

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.