IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/21/21

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 <u>not</u> 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 7/21/21 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
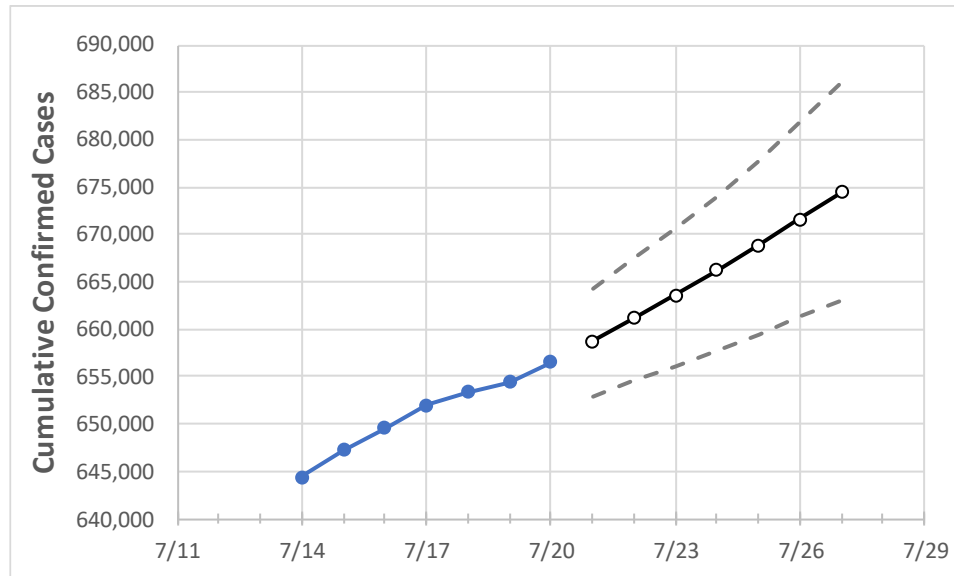
	Actual Confirmed Cases On:				Projected Cases For:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Missouri	651,966	653,331	654,368	656,484	658,781	661,184	663,598	666,200	668,860	671,600	674,434

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Boone	19,363	19,432	19,481	19,548	19,630	19,716	19,809	19,906	20,004	20,112	20,223
City of St. Louis	26,022	26,088	26,171	26,171	26,224	26,281	26,342	26,404	26,470	26,537	26,607
Greene	34,410	34,555	34,661	34,835	35,047	35,265	35,484	35,716	35,956	36,187	36,427
Jackson (& KC)	88,021	88,229	88,366	88,610	88,895	89,197	89,517	89,855	90,202	90,561	90,944
St. Charles	44,468	44,529	44,594	44,664	44,748	44,836	44,928	45,023	45,122	45,222	45,331
St. Louis	104,281	104,382	104,456	104,806	105,033	105,266	105,528	105,789	106,060	106,366	106,670

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:		
	7/17	7/18	7/19	7/20	7/22	7/24	7/26
Boone	19,363	19,432	19,481	19,548	19,716 (3,943) [946] {473}	19,906 (3,981) [955] {478}	20,112 (4,022) [965] {483}
City of St. Louis	26,022	26,088	26,171	26,171	26,281 (5,256) [1,261] {631}	26,404 (5,281) [1,267] {634}	26,537 (5,307) [1,274] {637}
Greene	34,410	34,555	34,661	34,835	35,265 (7,053) [1,693] {846}	35,716 (7,143) [1,714] {857}	36,187 (7,237) [1,737] {868}
Jackson (& KC)	88,021	88,229	88,366	88,610	89,197 (17,839) [4,281] {2,141}	89,855 (17,971) [4,313] {2,157}	90,561 (18,112) [4,347] {2,173}
St. Charles	44,468	44,529	44,594	44,664	44,836 (8,967) [2,152] {1,076}	45,023 (9,005) [2,161] {1,081}	45,222 (9,044) [2,171] {1,085}
St. Louis	104,281	104,382	104,456	104,806	105,266 (21,053) [5,053] {2,526}	105,789 (21,158) [5,078] {2,539}	106,366 (21,273) [5,106] {2,553}

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.