IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/22/21

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 10/22/21 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
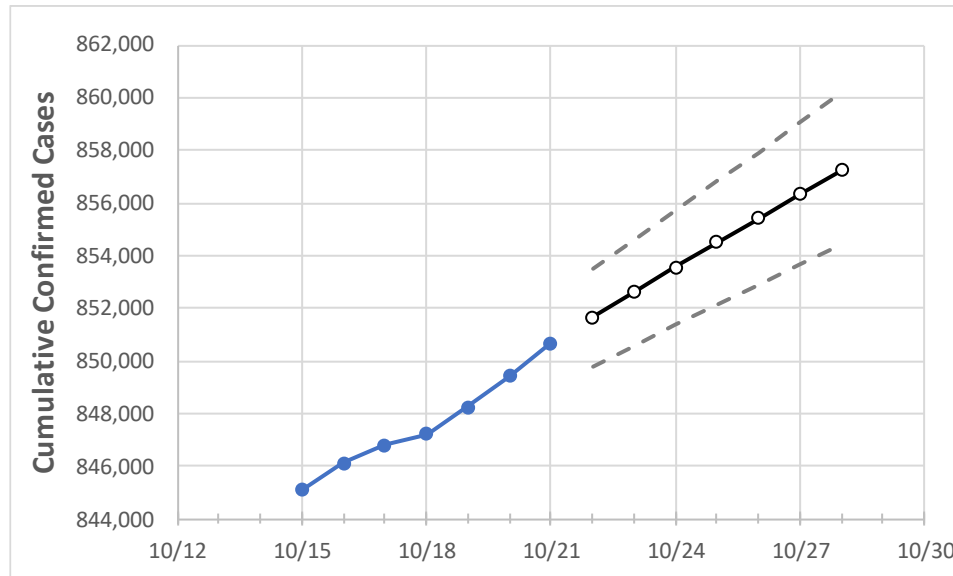
	Actual Confirmed Cases On:				Projected Cases For:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Missouri	847,219	848,234	849,415	850,689	851,640	852,622	853,563	854,497	855,413	856,342	857,229

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Boone	24,609	24,633	24,667	24,712	24,742	24,772	24,801	24,829	24,858	24,888	24,917
City of St. Louis	31,139	31,152	31,165	31,207	31,233	31,258	31,282	31,307	31,331	31,355	31,378
Greene	42,950	42,998	43,040	43,104	43,147	43,188	43,230	43,273	43,315	43,358	43,401
Jackson (& KC)	117,911	118,022	118,197	118,350	118,478	118,604	118,727	118,848	118,966	119,088	119,205
St. Charles	55,436	55,484	55,552	55,637	55,706	55,774	55,840	55,909	55,974	56,039	56,102
St. Louis	128,042	128,188	128,341	128,583	128,731	128,875	129,013	129,154	129,294	129,434	129,568

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:		
	10/18	10/19	10/20	10/21	10/23	10/25	10/27
Boone	24,609	24,633	24,667	24,712	24,772 (4,954) [1,189] {595}	24,829 (4,966) [1,192] {596}	24,888 (4,978) [1,195] {597}
City of St. Louis	31,139	31,152	31,165	31,207	31,258 (6,252) [1,500] {750}	31,307 (6,261) [1,503] {751}	31,355 (6,271) [1,505] {753}
Greene	42,950	42,998	43,040	43,104	43,188 (8,638) [2,073] {1,037}	43,273 (8,655) [2,077] {1,039}	43,358 (8,672) [2,081] {1,041}
Jackson (& KC)	117,911	118,022	118,197	118,350	118,604 (23,721) [5,693] {2,846}	118,848 (23,770) [5,705] {2,852}	119,088 (23,818) [5,716] {2,858}
St. Charles	55,436	55,484	55,552	55,637	55,774 (11,155) [2,677] {1,339}	55,909 (11,182) [2,684] {1,342}	56,039 (11,208) [2,690] {1,345}
St. Louis	128,042	128,188	128,341	128,583	128,875 (25,775) [6,186] {3,093}	129,154 (25,831) [6,199] {3,100}	129,434 (25,887) [6,213] {3,106}

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.