IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/17/21

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 12/17/21 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
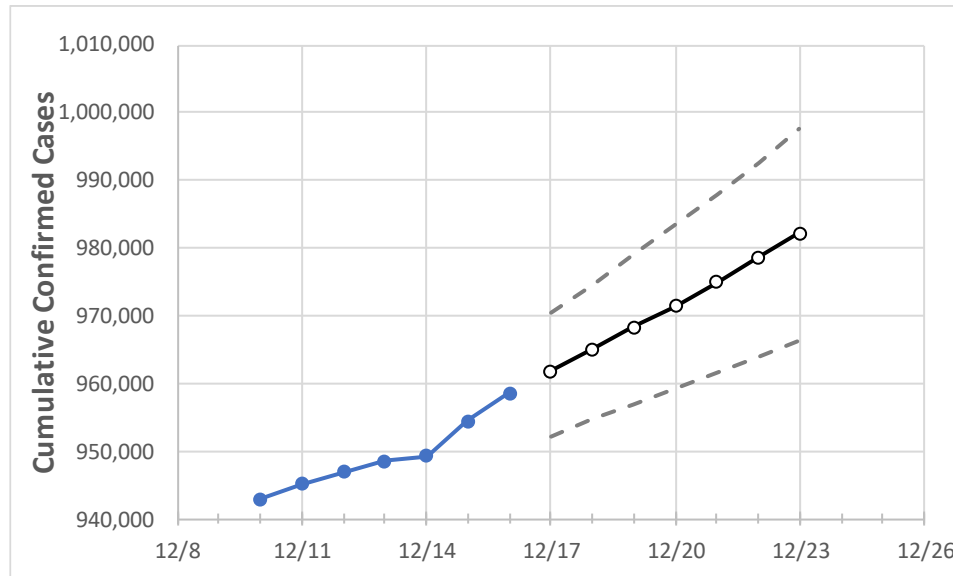
	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Missouri	948,493	949,201	954,483	958,606	961,772	965,017	968,326	971,471	974,987	978,605	982,177

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Boone	27,084	27,155	27,226	27,301	27,371	27,444	27,516	27,593	27,669	27,749	27,825
City of St. Louis	35,361	35,361	35,361	35,361	35,464	35,570	35,676	35,788	35,903	36,020	36,139
Greene	46,753	46,805	46,856	46,999	47,113	47,226	47,339	47,455	47,575	47,697	47,821
Jackson (& KC)	133,251	133,451	134,279	135,028	135,645	136,283	136,951	137,628	138,330	139,056	139,818
St. Charles	61,832	62,027	62,221	62,482	62,720	62,963	63,211	63,473	63,729	64,002	64,286
St. Louis	140,452	140,911	141,207	141,749	142,164	142,602	143,029	143,466	143,925	144,392	144,852

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:		
	12/13	12/14	12/15	12/16	12/18	12/20	12/22
Boone	27,084	27,155	27,226	27,301	27,444 (5,489) [1,317] {659}	27,593 (5,519) [1,324] {662}	27,749 (5,550) [1,332] {666}
City of St. Louis	35,361	35,361	35,361	35,361	35,570 (7,114) [1,707] {854}	35,788 (7,158) [1,718] {859}	36,020 (7,204) [1,729] {864}
Greene	46,753	46,805	46,856	46,999	47,226 (9,445) [2,267] {1,133}	47,455 (9,491) [2,278] {1,139}	47,697 (9,539) [2,289] {1,145}
Jackson (& KC)	133,251	133,451	134,279	135,028	136,283 (27,257) [6,542] {3,271}	137,628 (27,526) [6,606] {3,303}	139,056 (27,811) [6,675] {3,337}
St. Charles	61,832	62,027	62,221	62,482	62,963 (12,593) [3,022] {1,511}	63,473 (12,695) [3,047] {1,523}	64,002 (12,800) [3,072] {1,536}
St. Louis	140,452	140,911	141,207	141,749	142,602 (28,520) [6,845] {3,422}	143,466 (28,693) [6,886] {3,443}	144,392 (28,878) [6,931] {3,465}

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.