IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/17/21

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 11/17/21 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
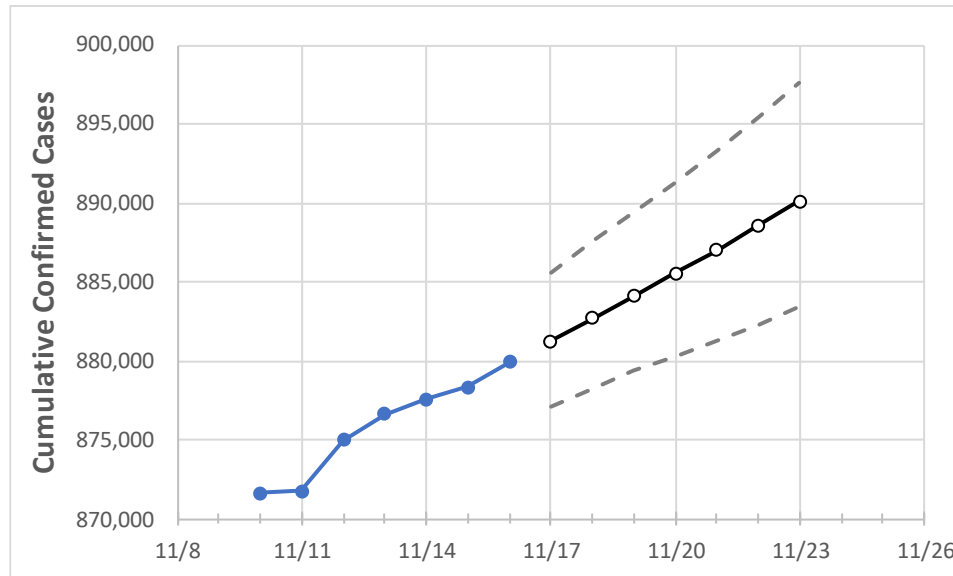
	Actual Confirmed Cases On:				Projected Cases For:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Missouri	876,614	877,578	878,314	879,913	881,269	882,671	884,086	885,545	886,999	888,573	890,108

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Boone	25,361	25,392	25,417	25,450	25,482	25,516	25,550	25,584	25,618	25,653	25,688
City of St. Louis	32,011	32,055	32,103	32,151	32,204	32,259	32,314	32,372	32,430	32,492	32,555
Greene	44,003	44,042	44,059	44,095	44,140	44,184	44,229	44,274	44,320	44,368	44,416
Jackson (& KC)	122,040	122,190	122,286	122,417	122,591	122,769	122,946	123,128	123,307	123,494	123,682
St. Charles	57,325	57,405	57,470	57,553	57,650	57,749	57,849	57,952	58,056	58,164	58,272
St. Louis	132,225	132,329	132,430	132,646	132,861	133,075	133,291	133,521	133,746	133,983	134,223

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:		
	11/13	11/14	11/15	11/16	11/18	11/20	11/22
Boone	25,361	25,392	25,417	25,450	25,516 (5,103) [1,225] {612}	25,584 (5,117) [1,228] {614}	25,653 (5,131) [1,231] {616}
City of St. Louis	32,011	32,055	32,103	32,151	32,259 (6,452) [1,548] {774}	32,372 (6,474) [1,554] {777}	32,492 (6,498) [1,560] {780}
Greene	44,003	44,042	44,059	44,095	44,184 (8,837) [2,121] {1,060}	44,274 (8,855) [2,125] {1,063}	44,368 (8,874) [2,130] {1,065}
Jackson (& KC)	122,040	122,190	122,286	122,417	122,769 (24,554) [5,893] {2,946}	123,128 (24,626) [5,910] {2,955}	123,494 (24,699) [5,928] {2,964}
St. Charles	57,325	57,405	57,470	57,553	57,749 (11,550) [2,772] {1,386}	57,952 (11,590) [2,782] {1,391}	58,164 (11,633) [2,792] {1,396}
St. Louis	132,225	132,329	132,430	132,646	133,075 (26,615) [6,388] {3,194}	133,521 (26,704) [6,409] {3,204}	133,983 (26,797) [6,431] {3,216}

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.