IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/2/21

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 8/2/21 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
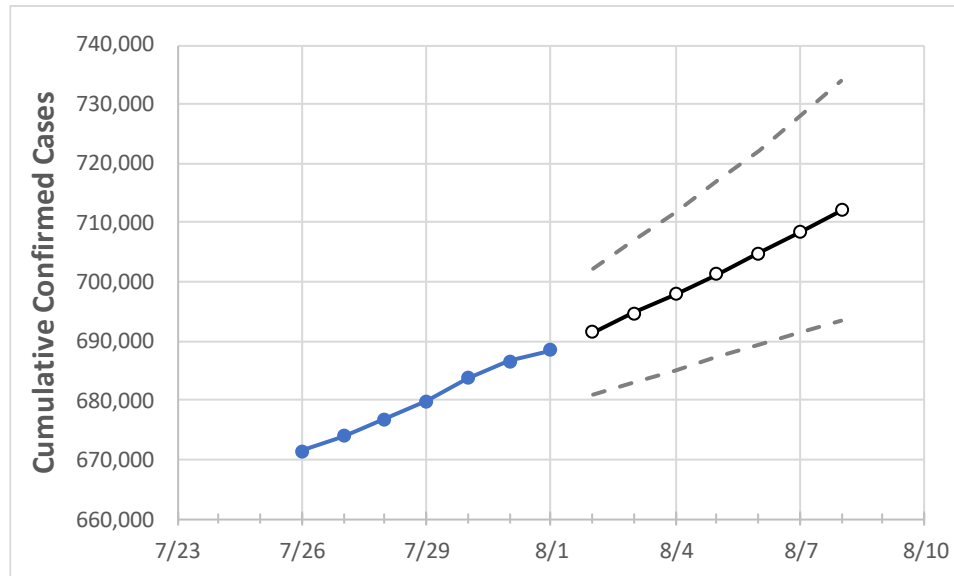
	Actual Confirmed Cases On:				Projected Cases For:						
	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8
Missouri	679,845	683,802	686,547	688,472	691,543	694,704	697,974	701,273	704,826	708,357	712,079

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:						
	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8
Boone	20,277	20,382	20,462	20,513	20,603	20,692	20,785	20,881	20,978	21,077	21,179
City of St. Louis	26,805	26,841	26,877	26,949	27,024	27,102	27,180	27,263	27,345	27,434	27,524
Greene	36,712	36,987	37,155	37,262	37,447	37,641	37,826	38,015	38,195	38,391	38,581
Jackson (& KC)	91,830	92,553	93,046	93,359	93,889	94,444	95,034	95,650	96,301	96,996	97,707
St. Charles	45,783	45,988	46,125	46,228	46,398	46,577	46,767	46,967	47,178	47,396	47,629
St. Louis	107,571	107,888	108,225	108,487	108,873	109,275	109,697	110,143	110,598	111,078	111,580

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:		
	7/29	7/30	7/31	8/1	8/3	8/5	8/7
Boone	20,277	20,382	20,462	20,513	20,692 (4,138) [993] {497}	20,881 (4,176) [1,002] {501}	21,077 (4,215) [1,012] {506}
City of St. Louis	26,805	26,841	26,877	26,949	27,102 (5,420) [1,301] {650}	27,263 (5,453) [1,309] {654}	27,434 (5,487) [1,317] {658}
Greene	36,712	36,987	37,155	37,262	37,641 (7,528) [1,807] {903}	38,015 (7,603) [1,825] {912}	38,391 (7,678) [1,843] {921}
Jackson (& KC)	91,830	92,553	93,046	93,359	94,444 (18,889) [4,533] {2,267}	95,650 (19,130) [4,591] {2,296}	96,996 (19,399) [4,656] {2,328}
St. Charles	45,783	45,988	46,125	46,228	46,577 (9,315) [2,236] {1,118}	46,967 (9,393) [2,254] {1,127}	47,396 (9,479) [2,275] {1,138}
St. Louis	107,571	107,888	108,225	108,487	109,275 (21,855) [5,245] {2,623}	110,143 (22,029) [5,287] {2,643}	111,078 (22,216) [5,332] {2,666}

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.