IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/10/21

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 9/10/21 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
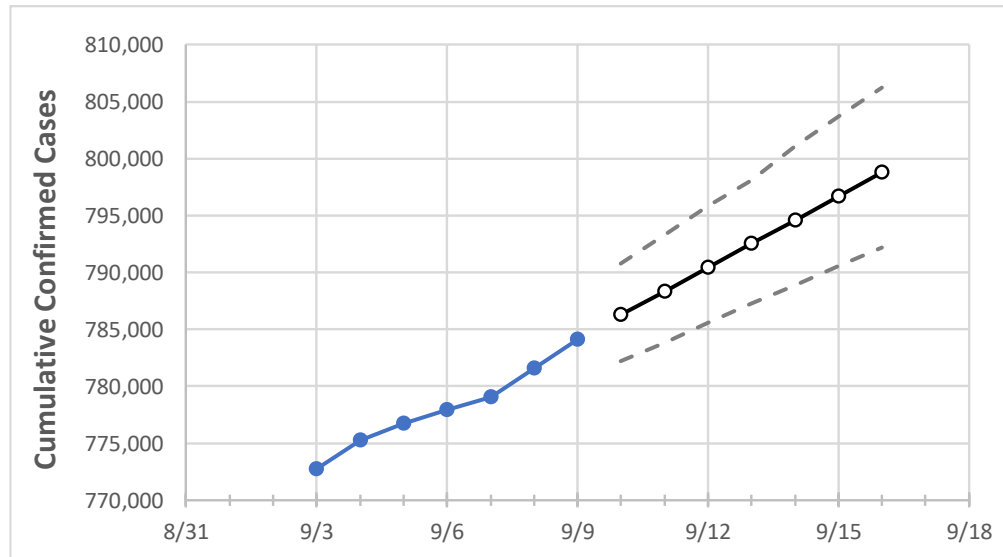
	Actual Confirmed Cases On:				Projected Cases For:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Missouri	777,915	779,030	781,592	784,110	786,259	788,329	790,400	792,499	794,571	796,679	798,765

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:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Boone	22,799	22,833	22,885	22,982	23,040	23,099	23,156	23,213	23,273	23,332	23,391
City of St. Louis	29,298	29,392	29,453	29,513	29,578	29,643	29,703	29,771	29,833	29,899	29,966
Greene	40,926	40,962	41,014	41,070	41,129	41,186	41,243	41,298	41,352	41,406	41,462
Jackson (& KC)	108,525	108,685	109,004	109,280	109,569	109,867	110,148	110,442	110,720	111,016	111,280
St. Charles	51,062	51,151	51,295	51,405	51,522	51,642	51,761	51,879	51,995	52,115	52,232
St. Louis	118,773	118,910	119,245	119,584	119,865	120,147	120,416	120,686	120,961	121,252	121,531

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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:		
	9/6	9/7	9/8	9/9	9/11	9/13	9/15
Boone	22,799	22,833	22,885	22,982	23,099 (4,620) [1,109] {554}	23,213 (4,643) [1,114] {557}	23,332 (4,666) [1,120] {560}
City of St. Louis	29,298	29,392	29,453	29,513	29,643 (5,929) [1,423] {711}	29,771 (5,954) [1,429] {715}	29,899 (5,980) [1,435] {718}
Greene	40,926	40,962	41,014	41,070	41,186 (8,237) [1,977] {988}	41,298 (8,260) [1,982] {991}	41,406 (8,281) [1,987] {994}
Jackson (& KC)	108,525	108,685	109,004	109,280	109,867 (21,973) [5,274] {2,637}	110,442 (22,088) [5,301] {2,651}	111,016 (22,203) [5,329] {2,664}
St. Charles	51,062	51,151	51,295	51,405	51,642 (10,328) [2,479] {1,239}	51,879 (10,376) [2,490] {1,245}	52,115 (10,423) [2,502] {1,251}
St. Louis	118,773	118,910	119,245	119,584	120,147 (24,029) [5,767] {2,884}	120,686 (24,137) [5,793] {2,896}	121,252 (24,250) [5,820] {2,910}

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.

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