IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/2/20

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 12/2/20 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
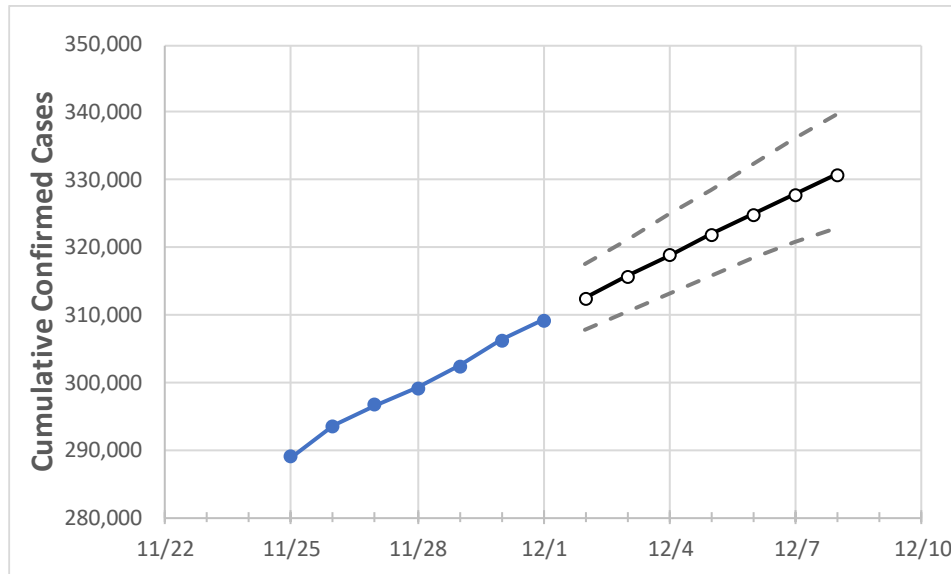
	Actual Confirmed Cases On:				Projected Cases For:						
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8
Missouri	299,095	302,409	306,206	309,169	312,434	315,633	318,770	321,846	324,863	327,822	330,724

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 20%, and are often within 10%, of actual confirmed cases.

Missouri Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8
Boone	10,193	10,311	10,349	10,389	10,442	10,492	10,540	10,586	10,630	10,672	10,712
City of St. Louis	12,774	12,960	13,032	13,188	13,342	13,498	13,654	13,811	13,969	14,128	14,288
Greene	13,711	13,825	14,071	14,166	14,295	14,424	14,551	14,678	14,803	14,928	15,052
Jackson (& KC)	39,906	40,346	40,904	41,375	41,835	42,290	42,739	43,182	43,620	44,052	44,478
St. Charles	19,731	19,964	20,229	20,512	20,766	21,015	21,260	21,500	21,736	21,968	22,195
St. Louis	50,729	51,324	51,819	52,421	53,057	53,688	54,314	54,935	55,552	56,164	56,772

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:		
	11/28	11/29	11/30	12/1	12/3	12/5	12/7
Boone	10,193	10,311	10,349	10,389	10,492 (2,098) [504] {252}	10,586 (2,117) [508] {254}	10,672 (2,134) [512] {256}
City of St. Louis	12,774	12,960	13,032	13,188	13,498 (2,700) [648] {324}	13,811 (2,762) [663] {331}	14,128 (2,826) [678] {339}
Greene	13,711	13,825	14,071	14,166	14,424 (2,885) [692] {346}	14,678 (2,936) [705] {352}	14,928 (2,986) [717] {358}
Jackson (& KC)	39,906	40,346	40,904	41,375	42,290 (8,458) [2,030] {1,015}	43,182 (8,636) [2,073] {1,036}	44,052 (8,810) [2,114] {1,057}
St. Charles	19,731	19,964	20,229	20,512	21,015 (4,203) [1,009] {504}	21,500 (4,300) [1,032] {516}	21,968 (4,394) [1,054] {527}
St. Louis	50,729	51,324	51,819	52,421	53,688 (10,738) [2,577] {1,289}	54,935 (10,987) [2,637] {1,318}	56,164 (11,233) [2,696] {1,348}

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.