IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/25/21

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 1/25/21 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.
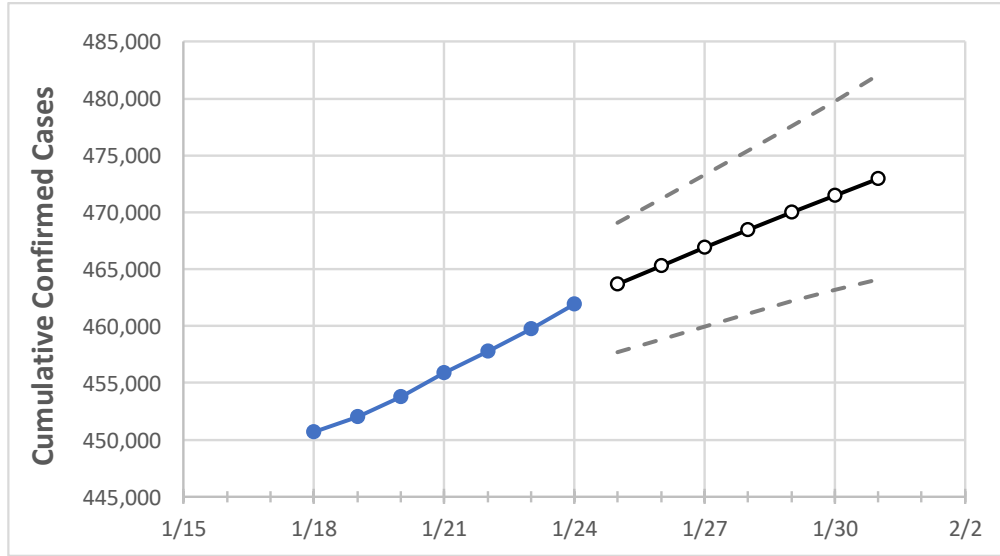
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Missouri	455,889	457,792	459,748	461,912	463,633	465,265	466,871	468,455	469,974	471,482	472,961

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Boone	14,839	14,909	14,968	15,026	15,077	15,128	15,177	15,226	15,271	15,321	15,368
City of St. Louis	17,679	17,770	17,852	17,987	18,037	18,089	18,143	18,200	18,260	18,321	18,385
Greene	21,606	21,711	21,801	21,871	21,947	22,021	22,092	22,163	22,230	22,296	22,361
Jackson (& KC)	61,193	61,405	61,726	62,327	62,616	62,901	63,184	63,464	63,743	64,020	64,289
St. Charles	30,679	30,812	30,916	31,019	31,135	31,247	31,357	31,467	31,574	31,674	31,775
St. Louis	79,875	80,285	80,771	81,147	81,528	81,900	82,268	82,637	82,997	83,345	83,691

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:		
	1/21	1/22	1/23	1/24	1/26	1/28	1/30
Boone	14,839	14,909	14,968	15,026	15,128 (3,026) [726] {363}	15,226 (3,045) [731] {365}	15,321 (3,064) [735] {368}
City of St. Louis	17,679	17,770	17,852	17,987	18,089 (3,618) [868] {434}	18,200 (3,640) [874] {437}	18,321 (3,664) [879] {440}
Greene	21,606	21,711	21,801	21,871	22,021 (4,404) [1,057] {529}	22,163 (4,433) [1,064] {532}	22,296 (4,459) [1,070] {535}
Jackson (& KC)	61,193	61,405	61,726	62,327	62,901 (12,580) [3,019] {1,510}	63,464 (12,693) [3,046] {1,523}	64,020 (12,804) [3,073] {1,536}
St. Charles	30,679	30,812	30,916	31,019	31,247 (6,249) [1,500] {750}	31,467 (6,293) [1,510] {755}	31,674 (6,335) [1,520] {760}
St. Louis	79,875	80,285	80,771	81,147	81,900 (16,380) [3,931] {1,966}	82,637 (16,527) [3,967] {1,983}	83,345 (16,669) [4,001] {2,000}

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.