IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/22/21

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 4/22/21 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
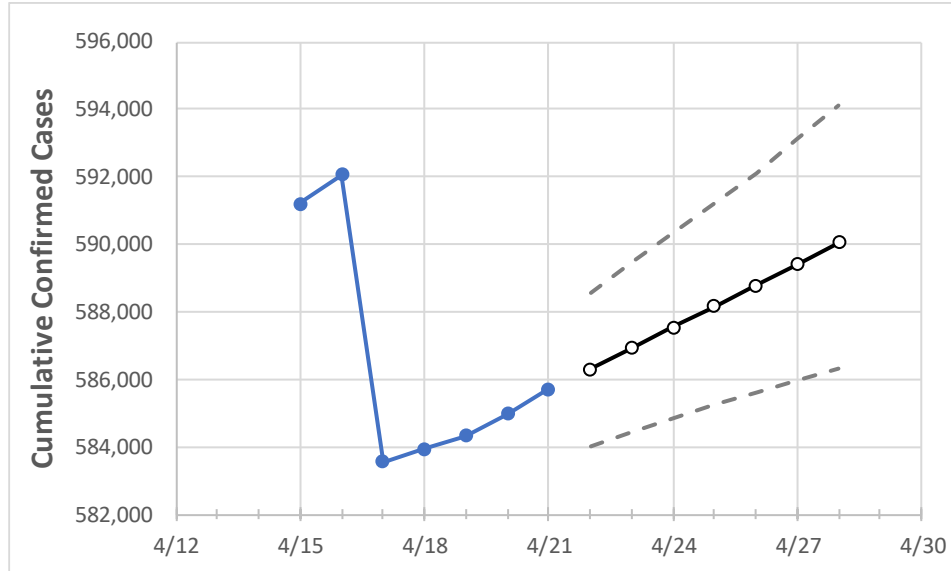
	Actual Confirmed Cases On:				Projected Cases For:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Missouri	583,941	584,326	584,983	585,701	586,306	586,930	587,551	588,175	588,790	589,415	590,045

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:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Boone	17,651	17,658	17,674	17,698	17,713	17,729	17,745	17,761	17,777	17,793	17,809
City of St. Louis	23,408	23,462	23,506	23,571	23,630	23,690	23,751	23,813	23,877	23,942	24,007
Greene	27,722	27,736	27,753	27,772	27,787	27,802	27,818	27,833	27,848	27,863	27,878
Jackson (& KC)	79,358	79,441	79,557	79,676	79,769	79,866	79,963	80,061	80,164	80,266	80,371
St. Charles	41,680	41,718	41,774	41,838	41,889	41,939	41,987	42,034	42,083	42,130	42,176
St. Louis	95,629	95,728	95,865	96,058	96,222	96,384	96,546	96,705	96,873	97,037	97,198

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: | | |
	4/18	4/19	4/20	4/21	4/23	4/25	4/27
Boone	17,651	17,658	17,674	17,698	17,729 (3,546) [851] {425}	17,761 (3,552) [853] {426}	17,793 (3,559) [854] {427}
City of St. Louis	23,408	23,462	23,506	23,571	23,690 (4,738) [1,137] {569}	23,813 (4,763) [1,143] {572}	23,942 (4,788) [1,149] {575}
Greene	27,722	27,736	27,753	27,772	27,802 (5,560) [1,335] {667}	27,833 (5,567) [1,336] {668}	27,863 (5,573) [1,337] {669}
Jackson (& KC)	79,358	79,441	79,557	79,676	79,866 (15,973) [3,834] {1,917}	80,061 (16,012) [3,843] {1,921}	80,266 (16,053) [3,853] {1,926}
St. Charles	41,680	41,718	41,774	41,838	41,939 (8,388) [2,013] {1,007}	42,034 (8,407) [2,018] {1,009}	42,130 (8,426) [2,022] {1,011}
St. Louis	95,629	95,728	95,865	96,058	96,384 (19,277) [4,626] {2,313}	96,705 (19,341) [4,642] {2,321}	97,037 (19,407) [4,658] {2,329}

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.