IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/20/21

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 4/20/21 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
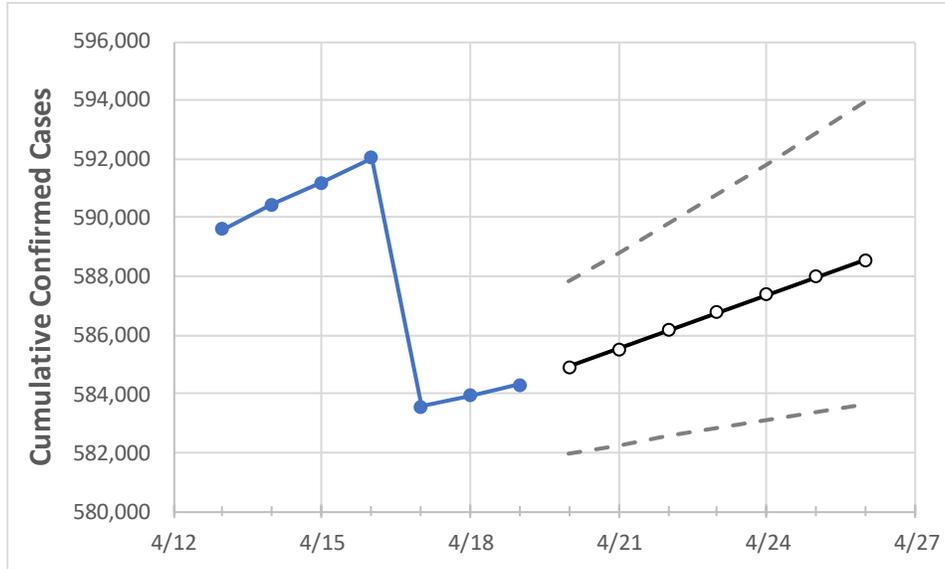
	Actual Confirmed Cases On:				Projected Cases For:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
Missouri	592,054	583,562	583,941	584,326	584,921	585,534	586,168	586,790	587,379	587,982	588,568

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:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
Boone	17,766	17,640	17,651	17,658	17,671	17,684	17,697	17,710	17,723	17,736	17,750
City of St. Louis	23,315	23,370	23,408	23,462	23,520	23,579	23,638	23,700	23,761	23,826	23,892
Greene	27,993	27,715	27,722	27,736	27,751	27,767	27,783	27,800	27,816	27,831	27,847
Jackson (& KC)	81,107	79,318	79,358	79,441	79,529	79,617	79,706	79,797	79,890	79,984	80,076
St. Charles	42,274	41,633	41,680	41,718	41,768	41,818	41,866	41,913	41,960	42,005	42,051
St. Louis	95,390	95,539	95,629	95,728	95,885	96,047	96,207	96,364	96,521	96,685	96,846

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: | | |
	4/16	4/17	4/18	4/19	4/21	4/23	4/25
Boone	17,766	17,640	17,651	17,658	17,684 (3,537) [849] {424}	17,710 (3,542) [850] {425}	17,736 (3,547) [851] {426}
City of St. Louis	23,315	23,370	23,408	23,462	23,579 (4,716) [1,132] {566}	23,700 (4,740) [1,138] {569}	23,826 (4,765) [1,144] {572}
Greene	27,993	27,715	27,722	27,736	27,767 (5,553) [1,333] {666}	27,800 (5,560) [1,334] {667}	27,831 (5,566) [1,336] {668}
Jackson (& KC)	81,107	79,318	79,358	79,441	79,617 (15,923) [3,822] {1,911}	79,797 (15,959) [3,830] {1,915}	79,984 (15,997) [3,839] {1,920}
St. Charles	42,274	41,633	41,680	41,718	41,818 (8,364) [2,007] {1,004}	41,913 (8,383) [2,012] {1,006}	42,005 (8,401) [2,016] {1,008}
St. Louis	95,390	95,539	95,629	95,728	96,047 (19,209) [4,610] {2,305}	96,364 (19,273) [4,625] {2,313}	96,685 (19,337) [4,641] {2,320}

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.