IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/24/21

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 5/24/21 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.

Alabama State Projections
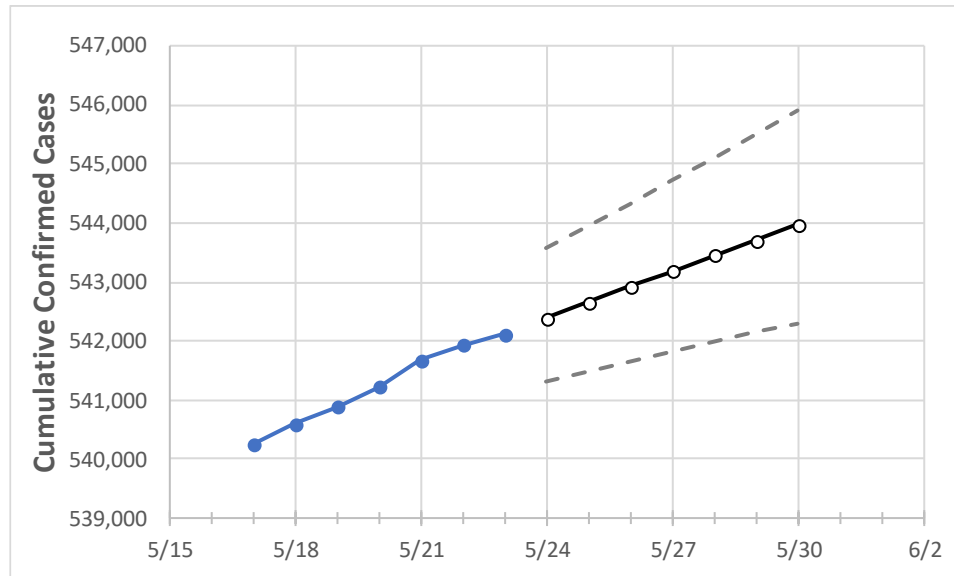
	Actual Confirmed Cases On:				Projected Cases For:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Alabama	541,230	541,673	541,928	542,124	542,391	542,652	542,920	543,184	543,445	543,710	543,973

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.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Jefferson	79,979	80,020	80,041	80,061	80,086	80,111	80,135	80,159	80,183	80,207	80,230
Lee	16,017	16,034	16,040	16,049	16,056	16,062	16,069	16,075	16,082	16,088	16,095
Madison	35,223	35,244	35,266	35,284	35,301	35,318	35,335	35,352	35,368	35,384	35,400
Marshall	12,300	12,319	12,323	12,325	12,332	12,339	12,345	12,352	12,359	12,365	12,371
Mobile	41,363	41,392	41,408	41,423	41,448	41,475	41,503	41,529	41,555	41,582	41,608
Montgomery	24,776	24,807	24,820	24,832	24,848	24,864	24,881	24,898	24,916	24,934	24,952
Shelby	25,322	25,330	25,347	25,352	25,361	25,370	25,380	25,389	25,397	25,406	25,415
Tuscaloosa	25,964	25,975	25,984	25,989	25,996	26,003	26,010	26,017	26,023	26,029	26,035

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.*

Alabama Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	5/20	5/21	5/22	5/23	5/25	5/27	5/29
Jefferson	79,979	80,020	80,041	80,061	80,111 (16,022) [3,845] {1,923}	80,159 (16,032) [3,848] {1,924}	80,207 (16,041) [3,850] {1,925}
Lee	16,017	16,034	16,040	16,049	16,062 (3,212) [771] {385}	16,075 (3,215) [772] {386}	16,088 (3,218) [772] {386}
Madison	35,223	35,244	35,266	35,284	35,318 (7,064) [1,695] {848}	35,352 (7,070) [1,697] {848}	35,384 (7,077) [1,698] {849}
Marshall	12,300	12,319	12,323	12,325	12,339 (2,468) [592] {296}	12,352 (2,470) [593] {296}	12,365 (2,473) [594] {297}
Mobile	41,363	41,392	41,408	41,423	41,475 (8,295) [1,991] {995}	41,529 (8,306) [1,993] {997}	41,582 (8,316) [1,996] {998}
Montgomery	24,776	24,807	24,820	24,832	24,864 (4,973) [1,193] {597}	24,898 (4,980) [1,195] {598}	24,934 (4,987) [1,197] {598}
Shelby	25,322	25,330	25,347	25,352	25,370 (5,074) [1,218] {609}	25,389 (5,078) [1,219] {609}	25,406 (5,081) [1,219] {610}
Tuscaloosa	25,964	25,975	25,984	25,989	26,003 (5,201) [1,248] {624}	26,017 (5,203) [1,249] {624}	26,029 (5,206) [1,249] {625}

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.