IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/14/21

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 5/14/21 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
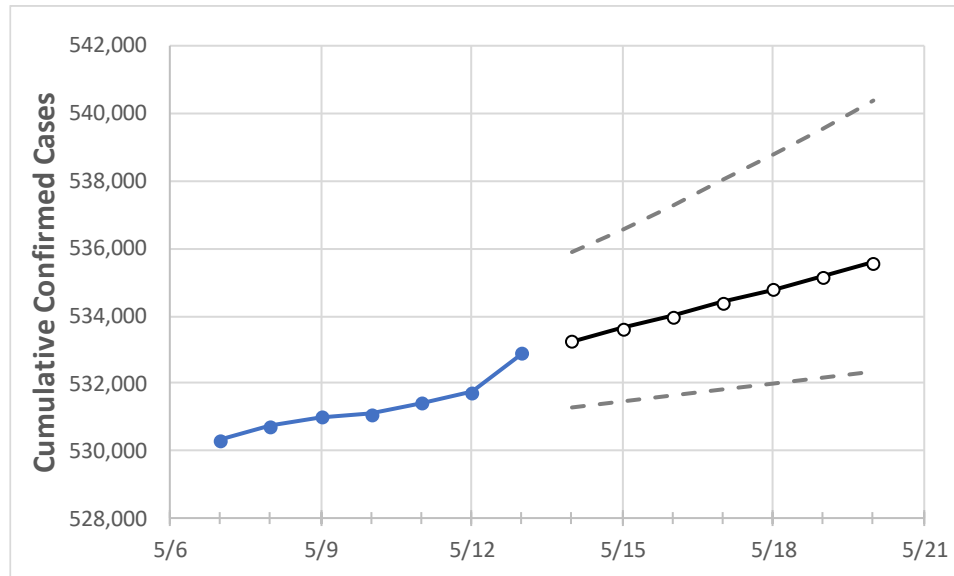
	Actual Confirmed Cases On:				Projected Cases For:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Alabama	531,094	531,404	531,751	532,895	533,256	533,633	533,999	534,396	534,786	535,182	535,584

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Jefferson	76,544	76,550	76,602	77,143	77,180	77,215	77,249	77,284	77,318	77,352	77,385
Lee	15,886	15,882	15,887	15,892	15,900	15,908	15,916	15,924	15,931	15,938	15,946
Madison	34,763	34,789	34,820	34,837	34,860	34,882	34,904	34,927	34,948	34,970	34,991
Marshall	12,227	12,232	12,239	12,250	12,258	12,265	12,272	12,280	12,287	12,294	12,301
Mobile	40,979	41,036	41,061	41,089	41,115	41,142	41,169	41,196	41,222	41,248	41,273
Montgomery	24,331	24,340	24,348	24,355	24,363	24,371	24,379	24,387	24,395	24,402	24,410
Shelby	23,440	23,449	23,465	23,730	23,741	23,752	23,763	23,775	23,786	23,797	23,808
Tuscaloosa	25,781	25,788	25,801	25,810	25,825	25,840	25,855	25,869	25,884	25,899	25,913

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:		
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Jefferson	76,544	76,550	76,602	77,143	77,215 (15,443) [3,706] {1,853}	77,284 (15,457) [3,710] {1,855}	77,352 (15,470) [3,713] {1,856}
Lee	15,886	15,882	15,887	15,892	15,908 (3,182) [764] {382}	15,924 (3,185) [764] {382}	15,938 (3,188) [765] {383}
Madison	34,763	34,789	34,820	34,837	34,882 (6,976) [1,674] {837}	34,927 (6,985) [1,676] {838}	34,970 (6,994) [1,679] {839}
Marshall	12,227	12,232	12,239	12,250	12,265 (2,453) [589] {294}	12,280 (2,456) [589] {295}	12,294 (2,459) [590] {295}
Mobile	40,979	41,036	41,061	41,089	41,142 (8,228) [1,975] {987}	41,196 (8,239) [1,977] {989}	41,248 (8,250) [1,980] {990}
Montgomery	24,331	24,340	24,348	24,355	24,371 (4,874) [1,170] {585}	24,387 (4,877) [1,171] {585}	24,402 (4,880) [1,171] {586}
Shelby	23,440	23,449	23,465	23,730	23,752 (4,750) [1,140] {570}	23,775 (4,755) [1,141] {571}	23,797 (4,759) [1,142] {571}
Tuscaloosa	25,781	25,788	25,801	25,810	25,840 (5,168) [1,240] {620}	25,869 (5,174) [1,242] {621}	25,899 (5,180) [1,243] {622}

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.