IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/13/21

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 5/13/21 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
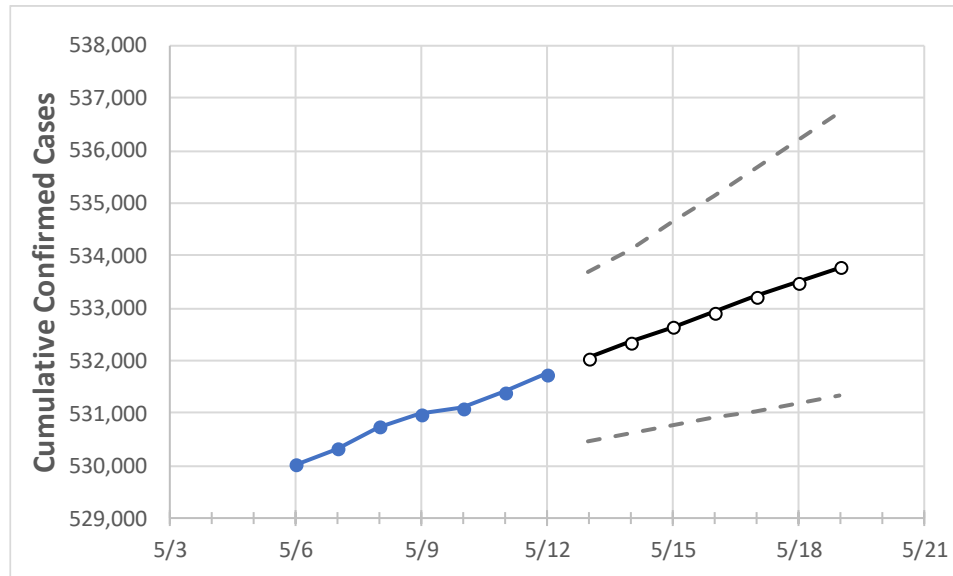
	Actual Confirmed Cases On:				Projected Cases For:						
	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19
Alabama	530,988	531,094	531,404	531,751	532,054	532,347	532,635	532,932	533,229	533,500	533,779

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:						
	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19
Jefferson	76,529	76,544	76,550	76,602	76,639	76,675	76,711	76,747	76,784	76,819	76,854
Lee	15,884	15,886	15,882	15,887	15,895	15,903	15,912	15,920	15,927	15,935	15,943
Madison	34,751	34,763	34,789	34,820	34,845	34,870	34,894	34,918	34,943	34,966	34,989
Marshall	12,222	12,227	12,232	12,239	12,246	12,254	12,262	12,269	12,276	12,283	12,290
Mobile	40,971	40,979	41,036	41,061	41,090	41,118	41,145	41,174	41,202	41,230	41,257
Montgomery	24,329	24,331	24,340	24,348	24,357	24,366	24,375	24,384	24,393	24,401	24,409
Shelby	23,431	23,440	23,449	23,465	23,476	23,488	23,499	23,511	23,523	23,535	23,547
Tuscaloosa	25,775	25,781	25,788	25,801	25,817	25,833	25,849	25,864	25,881	25,896	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:		
	5/9	5/10	5/11	5/12	5/14	5/16	5/18
Jefferson	76,529	76,544	76,550	76,602	76,675 (15,335) [3,680] {1,840}	76,747 (15,349) [3,684] {1,842}	76,819 (15,364) [3,687] {1,844}
Lee	15,884	15,886	15,882	15,887	15,903 (3,181) [763] {382}	15,920 (3,184) [764] {382}	15,935 (3,187) [765] {382}
Madison	34,751	34,763	34,789	34,820	34,870 (6,974) [1,674] {837}	34,918 (6,984) [1,676] {838}	34,966 (6,993) [1,678] {839}
Marshall	12,222	12,227	12,232	12,239	12,254 (2,451) [588] {294}	12,269 (2,454) [589] {294}	12,283 (2,457) [590] {295}
Mobile	40,971	40,979	41,036	41,061	41,118 (8,224) [1,974] {987}	41,174 (8,235) [1,976] {988}	41,230 (8,246) [1,979] {990}
Montgomery	24,329	24,331	24,340	24,348	24,366 (4,873) [1,170] {585}	24,384 (4,877) [1,170] {585}	24,401 (4,880) [1,171] {586}
Shelby	23,431	23,440	23,449	23,465	23,488 (4,698) [1,127] {564}	23,511 (4,702) [1,129] {564}	23,535 (4,707) [1,130] {565}
Tuscaloosa	25,775	25,781	25,788	25,801	25,833 (5,167) [1,240] {620}	25,864 (5,173) [1,241] {621}	25,896 (5,179) [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.