IEM's AI Modeling: Short-term COVID-19 Projections

Date: 5/11/21

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 5/11/21 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.

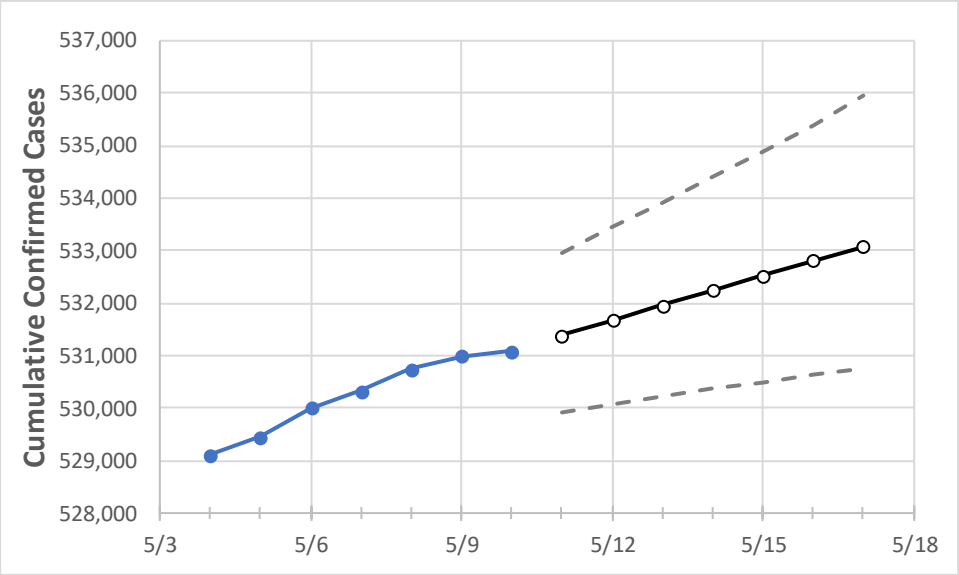
IEM's Modeling Lead

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Alabama	530,325	530,744	530,988	531,094	531,389	531,675	531,971	532,254	532,537	532,822	533,090

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Jefferson	76,397	76,493	76,529	76,544	76,584	76,625	76,665	76,705	76,745	76,783	76,822
Lee	15,856	15,873	15,884	15,886	15,896	15,905	15,914	15,922	15,931	15,940	15,949
Madison	34,717	34,735	34,751	34,763	34,788	34,812	34,835	34,858	34,882	34,903	34,925
Marshall	12,210	12,213	12,222	12,222	12,231	12,240	12,249	12,259	12,268	12,277	12,286
Mobile	40,908	40,959	40,971	40,979	41,003	41,026	41,048	41,070	41,093	41,116	41,138
Montgomery	24,314	24,327	24,329	24,331	24,342	24,352	24,362	24,372	24,381	24,390	24,399
Shelby	23,401	23,425	23,431	23,431	23,442	23,453	23,463	23,473	23,484	23,494	23,505
Tuscaloosa	25,730	25,749	25,775	25,781	25,798	25,816	25,834	25,852	25,871	25,889	25,908

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:		
	5/7	5/8	5/9	5/10	5/12	5/14	5/16
Jefferson	76,397	76,493	76,529	76,544	76,625 (15,325) [3,678] {1,839}	76,705 (15,341) [3,682] {1,841}	76,783 (15,357) [3,686] {1,843}
Lee	15,856	15,873	15,884	15,886	15,905 (3,181) [763] {382}	15,922 (3,184) [764] {382}	15,940 (3,188) [765] {383}
Madison	34,717	34,735	34,751	34,763	34,812 (6,962) [1,671] {835}	34,858 (6,972) [1,673] {837}	34,903 (6,981) [1,675] {838}
Marshall	12,210	12,213	12,222	12,222	12,240 (2,448) [588] {294}	12,259 (2,452) [588] {294}	12,277 (2,455) [589] {295}
Mobile	40,908	40,959	40,971	40,979	41,026 (8,205) [1,969] {985}	41,070 (8,214) [1,971] {986}	41,116 (8,223) [1,974] {987}
Montgomery	24,314	24,327	24,329	24,331	24,352 (4,870) [1,169] {584}	24,372 (4,874) [1,170] {585}	24,390 (4,878) [1,171] {585}
Shelby	23,401	23,425	23,431	23,431	23,453 (4,691) [1,126] {563}	23,473 (4,695) [1,127] {563}	23,494 (4,699) [1,128] {564}
Tuscaloosa	25,730	25,749	25,775	25,781	25,816 (5,163) [1,239] {620}	25,852 (5,170) [1,241] {620}	25,889 (5,178) [1,243] {621}

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.