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

Date: 6/3/21

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 6/3/21 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.

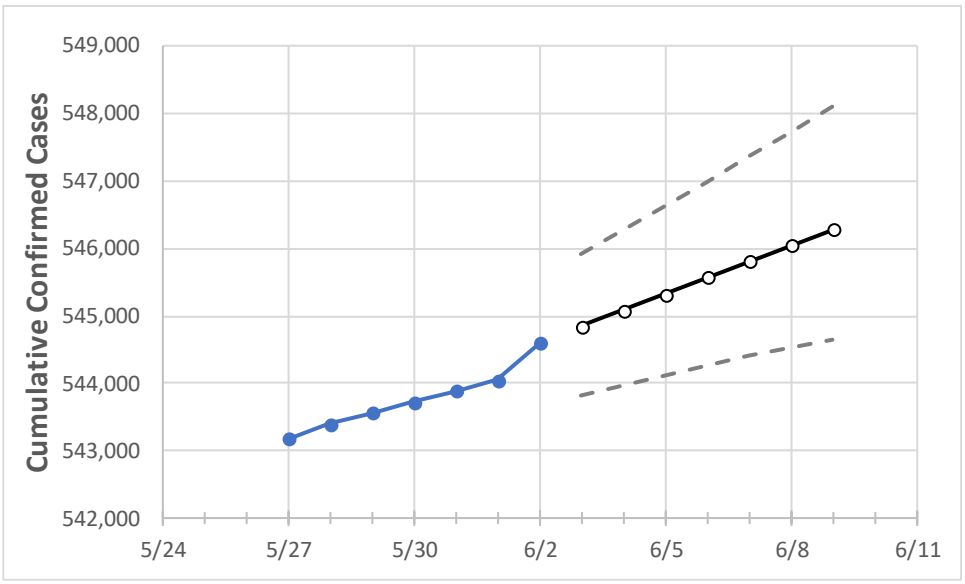
IEM's Modeling Lead

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Alabama	543,725	543,885	544,045	544,598	544,841	545,080	545,318	545,565	545,805	546,041	546,275

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Jefferson	80,228	80,244	80,260	80,436	80,477	80,520	80,564	80,609	80,656	80,704	80,755
Lee	16,125	16,130	16,135	16,153	16,163	16,173	16,183	16,193	16,203	16,213	16,223
Madison	35,357	35,363	35,369	35,393	35,403	35,413	35,422	35,431	35,439	35,448	35,456
Marshall	12,343	12,346	12,348	12,364	12,368	12,371	12,375	12,378	12,382	12,385	12,388
Mobile	41,571	41,580	41,590	41,612	41,626	41,640	41,653	41,665	41,677	41,689	41,701
Montgomery	24,884	24,890	24,896	24,958	24,973	24,989	25,004	25,020	25,036	25,053	25,070
Shelby	25,419	25,428	25,437	25,446	25,455	25,463	25,472	25,481	25,489	25,498	25,506
Tuscaloosa	26,049	26,058	26,067	26,072	26,079	26,086	26,093	26,099	26,106	26,112	26,118

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:		
	5/30	5/31	6/1	6/2	6/4	6/6	6/8
Jefferson	80,228	80,244	80,260	80,436	80,520 (16,104) [3,865] {1,932}	80,609 (16,122) [3,869] {1,935}	80,704 (16,141) [3,874] {1,937}
Lee	16,125	16,130	16,135	16,153	16,173 (3,235) [776] {388}	16,193 (3,239) [777] {389}	16,213 (3,243) [778] {389}
Madison	35,357	35,363	35,369	35,393	35,413 (7,083) [1,700] {850}	35,431 (7,086) [1,701] {850}	35,448 (7,090) [1,701] {851}
Marshall	12,343	12,346	12,348	12,364	12,371 (2,474) [594] {297}	12,378 (2,476) [594] {297}	12,385 (2,477) [594] {297}
Mobile	41,571	41,580	41,590	41,612	41,640 (8,328) [1,999] {999}	41,665 (8,333) [2,000] {1,000}	41,689 (8,338) [2,001] {1,001}
Montgomery	24,884	24,890	24,896	24,958	24,989 (4,998) [1,199] {600}	25,020 (5,004) [1,201] {600}	25,053 (5,011) [1,203] {601}
Shelby	25,419	25,428	25,437	25,446	25,463 (5,093) [1,222] {611}	25,481 (5,096) [1,223] {612}	25,498 (5,100) [1,224] {612}
Tuscaloosa	26,049	26,058	26,067	26,072	26,086 (5,217) [1,252] {626}	26,099 (5,220) [1,253] {626}	26,112 (5,222) [1,253] {627}

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.