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

Date: 5/21/21

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 5/21 /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.

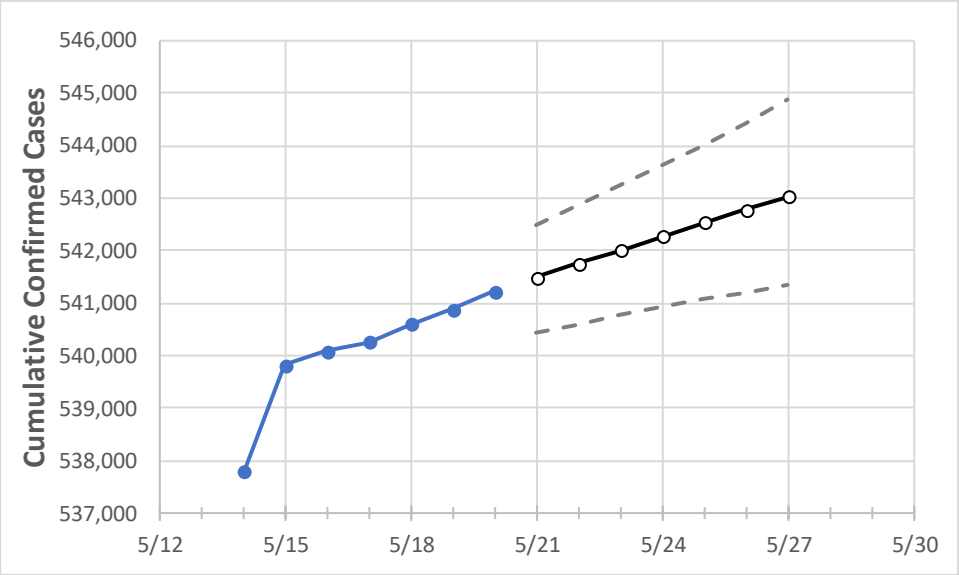
IEM's Modeling Lead

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Alabama	540,267	540,603	540,891	541,230	541,494	541,758	542,011	542,274	542,535	542,790	543,039

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Jefferson	79,879	79,916	79,964	79,979	80,008	80,037	80,064	80,091	80,118	80,143	80,169
Lee	15,997	16,005	16,011	16,017	16,022	16,027	16,032	16,037	16,042	16,046	16,051
Madison	35,175	35,191	35,193	35,223	35,240	35,257	35,273	35,288	35,304	35,319	35,334
Marshall	12,283	12,285	12,293	12,300	12,306	12,313	12,319	12,325	12,332	12,338	12,344
Mobile	41,295	41,331	41,337	41,363	41,395	41,426	41,460	41,492	41,526	41,558	41,591
Montgomery	24,736	24,747	24,763	24,776	24,785	24,795	24,804	24,813	24,822	24,831	24,840
Shelby	25,309	25,315	25,330	25,322	25,332	25,341	25,350	25,360	25,369	25,378	25,387
Tuscaloosa	25,932	25,943	25,947	25,964	25,973	25,982	25,990	25,998	26,006	26,014	26,021

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:		
	5/17	5/18	5/19	5/20	5/22	5/24	5/26
Jefferson	79,879	79,916	79,964	79,979	80,037 (16,007) [3,842] {1,921}	80,091 (16,018) [3,844] {1,922}	80,143 (16,029) [3,847] {1,923}
Lee	15,997	16,005	16,011	16,017	16,027 (3,205) [769] {385}	16,037 (3,207) [770] {385}	16,046 (3,209) [770] {385}
Madison	35,175	35,191	35,193	35,223	35,257 (7,051) [1,692] {846}	35,288 (7,058) [1,694] {847}	35,319 (7,064) [1,695] {848}
Marshall	12,283	12,285	12,293	12,300	12,313 (2,463) [591] {296}	12,325 (2,465) [592] {296}	12,338 (2,468) [592] {296}
Mobile	41,295	41,331	41,337	41,363	41,426 (8,285) [1,988] {994}	41,492 (8,298) [1,992] {996}	41,558 (8,312) [1,995] {997}
Montgomery	24,736	24,747	24,763	24,776	24,795 (4,959) [1,190] {595}	24,813 (4,963) [1,191] {596}	24,831 (4,966) [1,192] {596}
Shelby	25,309	25,315	25,330	25,322	25,341 (5,068) [1,216] {608}	25,360 (5,072) [1,217] {609}	25,378 (5,076) [1,218] {609}
Tuscaloosa	25,932	25,943	25,947	25,964	25,982 (5,196) [1,247] {624}	25,998 (5,200) [1,248] {624}	26,014 (5,203) [1,249] {624}

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.