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

Date: 7/16/21

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 7/16/21 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.

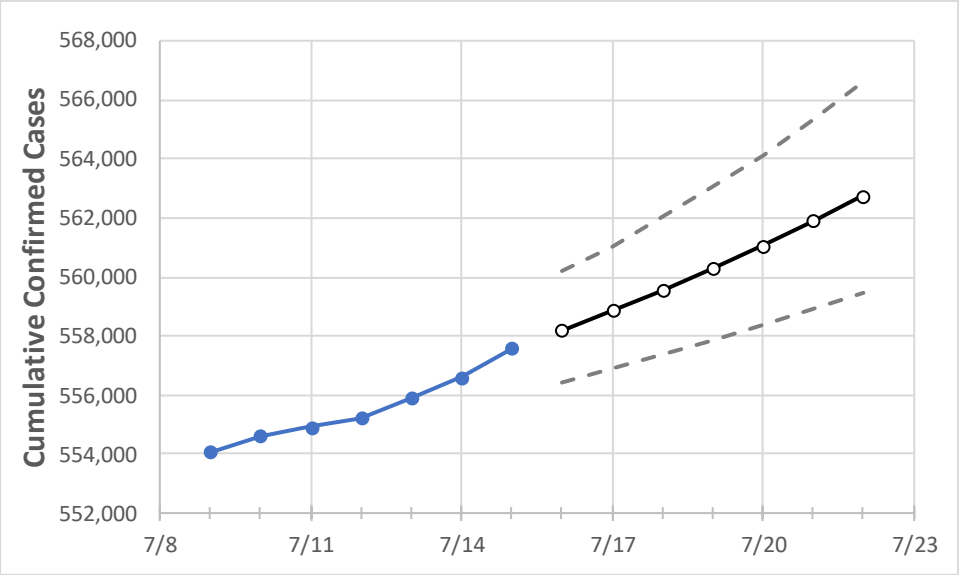
IEM's Modeling Lead

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Alabama	555,215	555,914	556,613	557,578	558,211	558,866	559,558	560,301	561,082	561,900	562,747

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Jefferson	81,730	81,796	81,862	81,957	82,017	82,079	82,144	82,212	82,283	82,358	82,435
Lee	16,454	16,469	16,483	16,513	16,528	16,543	16,560	16,579	16,597	16,617	16,638
Madison	36,047	36,086	36,125	36,171	36,201	36,232	36,264	36,298	36,334	36,371	36,411
Marshall	12,568	12,581	12,594	12,609	12,620	12,631	12,643	12,656	12,669	12,684	12,699
Mobile	43,114	43,208	43,301	43,476	43,588	43,707	43,831	43,963	44,106	44,255	44,414
Montgomery	25,266	25,296	25,325	25,364	25,391	25,422	25,455	25,491	25,531	25,572	25,618
Shelby	25,959	25,992	26,024	26,060	26,093	26,128	26,165	26,204	26,245	26,289	26,334
Tuscaloosa	26,346	26,358	26,369	26,389	26,403	26,417	26,432	26,447	26,463	26,479	26,496

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:		
	7/12	7/13	7/14	7/15	7/17	7/19	7/21
Jefferson	81,730	81,796	81,862	81,957	82,079 (16,416) [3,940] {1,970}	82,212 (16,442) [3,946] {1,973}	82,358 (16,472) [3,953] {1,977}
Lee	16,454	16,469	16,483	16,513	16,543 (3,309) [794] {397}	16,579 (3,316) [796] {398}	16,617 (3,323) [798] {399}
Madison	36,047	36,086	36,125	36,171	36,232 (7,246) [1,739] {870}	36,298 (7,260) [1,742] {871}	36,371 (7,274) [1,746] {873}
Marshall	12,568	12,581	12,594	12,609	12,631 (2,526) [606] {303}	12,656 (2,531) [607] {304}	12,684 (2,537) [609] {304}
Mobile	43,114	43,208	43,301	43,476	43,707 (8,741) [2,098] {1,049}	43,963 (8,793) [2,110] {1,055}	44,255 (8,851) [2,124] {1,062}
Montgomery	25,266	25,296	25,325	25,364	25,422 (5,084) [1,220] {610}	25,491 (5,098) [1,224] {612}	25,572 (5,114) [1,227] {614}
Shelby	25,959	25,992	26,024	26,060	26,128 (5,226) [1,254] {627}	26,204 (5,241) [1,258] {629}	26,289 (5,258) [1,262] {631}
Tuscaloosa	26,346	26,358	26,369	26,389	26,417 (5,283) [1,268] {634}	26,447 (5,289) [1,269] {635}	26,479 (5,296) [1,271] {635}

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.