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

Date: 7/23/21

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 7/23/21 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.

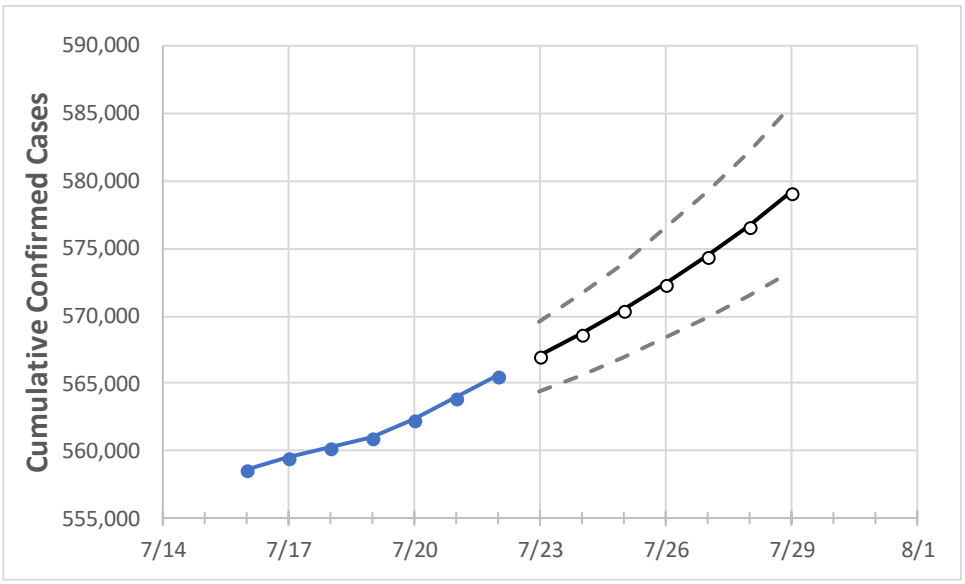
IEM's Modeling Lead

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Alabama	560,920	562,311	563,943	565,510	567,014	568,656	570,417	572,327	574,391	576,638	579,101

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Jefferson	82,320	82,487	82,655	82,806	82,970	83,149	83,343	83,553	83,782	84,030	84,303
Lee	16,587	16,630	16,666	16,691	16,722	16,755	16,790	16,828	16,869	16,912	16,958
Madison	36,330	36,372	36,439	36,534	36,601	36,673	36,751	36,832	36,922	37,017	37,119
Marshall	12,656	12,671	12,695	12,723	12,744	12,766	12,790	12,816	12,845	12,874	12,906
Mobile	44,111	44,363	44,695	44,938	45,237	45,569	45,931	46,331	46,780	47,271	47,806
Montgomery	25,470	25,521	25,558	25,598	25,645	25,695	25,751	25,812	25,876	25,946	26,022
Shelby	26,225	26,270	26,332	26,409	26,474	26,544	26,619	26,700	26,789	26,884	26,987
Tuscaloosa	26,463	26,491	26,561	26,589	26,627	26,667	26,712	26,760	26,814	26,873	26,936

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:		
	7/19	7/20	7/21	7/22	7/24	7/26	7/28
Jefferson	82,320	82,487	82,655	82,806	83,149 (16,630) [3,991] {1,996}	83,553 (16,711) [4,011] {2,005}	84,030 (16,806) [4,033] {2,017}
Lee	16,587	16,630	16,666	16,691	16,755 (3,351) [804] {402}	16,828 (3,366) [808] {404}	16,912 (3,382) [812] {406}
Madison	36,330	36,372	36,439	36,534	36,673 (7,335) [1,760] {880}	36,832 (7,366) [1,768] {884}	37,017 (7,403) [1,777] {888}
Marshall	12,656	12,671	12,695	12,723	12,766 (2,553) [613] {306}	12,816 (2,563) [615] {308}	12,874 (2,575) [618] {309}
Mobile	44,111	44,363	44,695	44,938	45,569 (9,114) [2,187] {1,094}	46,331 (9,266) [2,224] {1,112}	47,271 (9,454) [2,269] {1,135}
Montgomery	25,470	25,521	25,558	25,598	25,695 (5,139) [1,233] {617}	25,812 (5,162) [1,239] {619}	25,946 (5,189) [1,245] {623}
Shelby	26,225	26,270	26,332	26,409	26,544 (5,309) [1,274] {637}	26,700 (5,340) [1,282] {641}	26,884 (5,377) [1,290] {645}
Tuscaloosa	26,463	26,491	26,561	26,589	26,667 (5,333) [1,280] {640}	26,760 (5,352) [1,284] {642}	26,873 (5,375) [1,290] {645}

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.