IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/10/21

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 12/10/21 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
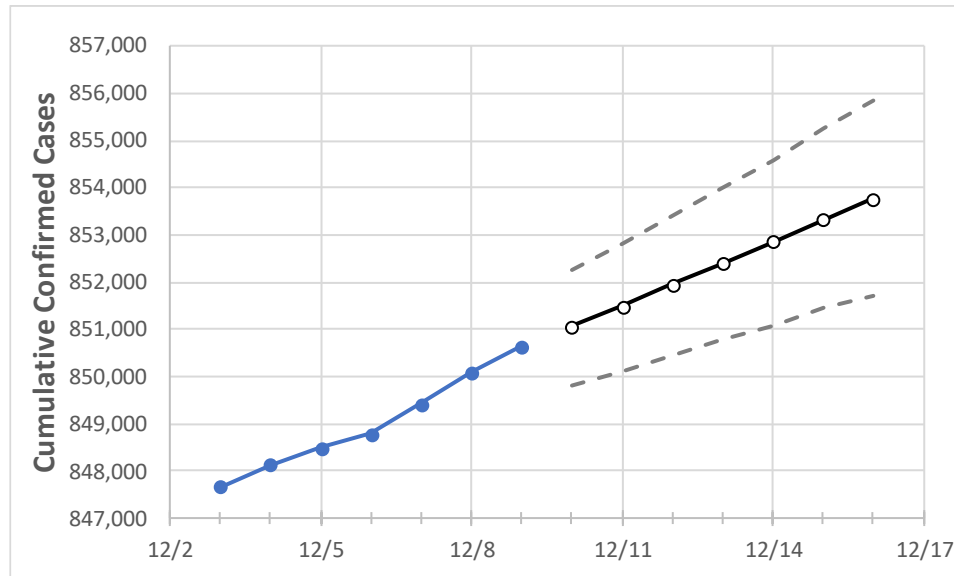
	Actual Confirmed Cases On:				Projected Cases For:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Alabama	848,779	849,409	850,096	850,645	851,070	851,496	851,961	852,402	852,867	853,329	853,774

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Jefferson	116,458	116,504	116,541	116,530	116,568	116,607	116,645	116,683	116,725	116,766	116,804
Lee	25,690	25,712	25,747	25,729	25,754	25,780	25,806	25,834	25,862	25,892	25,922
Madison	53,563	53,605	53,666	53,756	53,797	53,836	53,878	53,921	53,963	54,009	54,052
Marshall	18,865	18,878	18,891	18,908	18,921	18,933	18,946	18,960	18,975	18,989	19,003
Mobile	74,460	74,495	74,536	74,565	74,592	74,619	74,646	74,674	74,699	74,728	74,754
Montgomery	34,573	34,599	34,620	34,616	34,631	34,644	34,658	34,674	34,689	34,704	34,718
Shelby	38,454	38,474	38,507	38,530	38,544	38,560	38,575	38,590	38,605	38,621	38,637
Tuscaloosa	36,172	36,225	36,254	36,279	36,300	36,320	36,342	36,363	36,385	36,407	36,428

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:		
	12/6	12/7	12/8	12/9	12/11	12/13	12/15
Jefferson	116,458	116,504	116,541	116,530	116,607 (23,321) [5,597] {2,799}	116,683 (23,337) [5,601] {2,800}	116,766 (23,353) [5,605] {2,802}
Lee	25,690	25,712	25,747	25,729	25,780 (5,156) [1,237] {619}	25,834 (5,167) [1,240] {620}	25,892 (5,178) [1,243] {621}
Madison	53,563	53,605	53,666	53,756	53,836 (10,767) [2,584] {1,292}	53,921 (10,784) [2,588] {1,294}	54,009 (10,802) [2,592] {1,296}
Marshall	18,865	18,878	18,891	18,908	18,933 (3,787) [909] {454}	18,960 (3,792) [910] {455}	18,989 (3,798) [911] {456}
Mobile	74,460	74,495	74,536	74,565	74,619 (14,924) [3,582] {1,791}	74,674 (14,935) [3,584] {1,792}	74,728 (14,946) [3,587] {1,793}
Montgomery	34,573	34,599	34,620	34,616	34,644 (6,929) [1,663] {831}	34,674 (6,935) [1,664] {832}	34,704 (6,941) [1,666] {833}
Shelby	38,454	38,474	38,507	38,530	38,560 (7,712) [1,851] {925}	38,590 (7,718) [1,852] {926}	38,621 (7,724) [1,854] {927}
Tuscaloosa	36,172	36,225	36,254	36,279	36,320 (7,264) [1,743] {872}	36,363 (7,273) [1,745] {873}	36,407 (7,281) [1,748] {874}

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.