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

Date: 1/6/21

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 1/6/21 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.

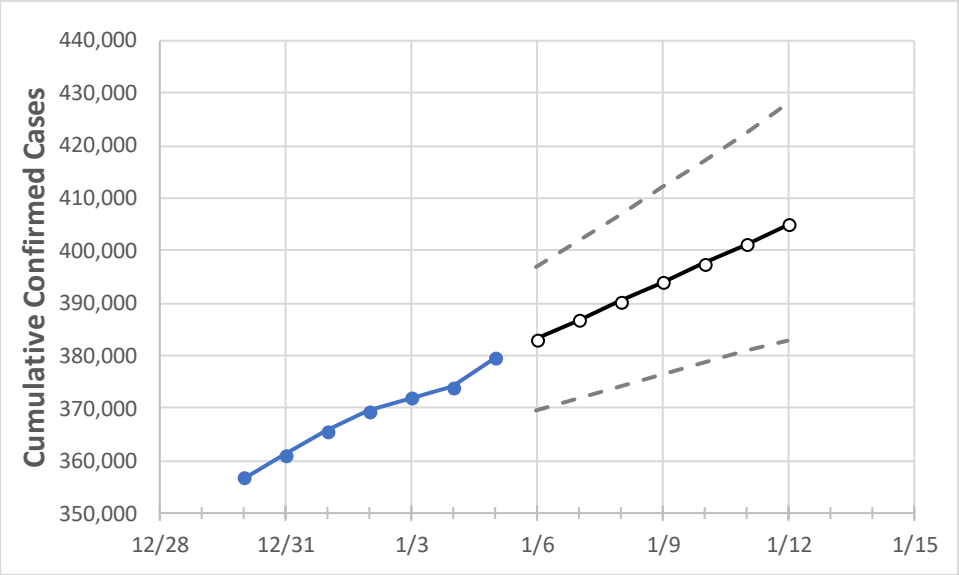
IEM's Modeling Lead

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Alabama	369,458	371,934	374,095	379,593	383,205	386,789	390,417	394,043	397,695	401,295	404,976

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Jefferson	53,621	54,012	54,349	55,344	55,941	56,522	57,122	57,702	58,278	58,870	59,450
Lee	10,508	10,560	10,656	10,765	10,860	10,956	11,055	11,153	11,254	11,355	11,458
Madison	23,115	23,364	23,563	23,840	24,110	24,386	24,665	24,944	25,225	25,494	25,779
Marshall	9,293	9,314	9,340	9,401	9,449	9,500	9,550	9,598	9,645	9,690	9,738
Mobile	26,431	26,677	26,854	27,099	27,360	27,627	27,898	28,168	28,444	28,727	29,014
Montgomery	16,333	16,446	16,615	17,061	17,228	17,395	17,569	17,748	17,928	18,111	18,305
Shelby	16,034	16,186	16,323	16,622	16,799	16,978	17,161	17,338	17,523	17,711	17,893
Tuscaloosa	18,947	19,043	19,161	19,288	19,441	19,597	19,755	19,909	20,063	20,212	20,362

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:		
	1/2	1/3	1/4	1/5	1/7	1/9	1/11
Jefferson	53,621	54,012	54,349	55,344	56,522 (11,304) [2,713] {1,357}	57,702 (11,540) [2,770] {1,385}	58,870 (11,774) [2,826] {1,413}
Lee	10,508	10,560	10,656	10,765	10,956 (2,191) [526] {263}	11,153 (2,231) [535] {268}	11,355 (2,271) [545] {273}
Madison	23,115	23,364	23,563	23,840	24,386 (4,877) [1,171] {585}	24,944 (4,989) [1,197] {599}	25,494 (5,099) [1,224] {612}
Marshall	9,293	9,314	9,340	9,401	9,500 (1,900) [456] {228}	9,598 (1,920) [461] {230}	9,690 (1,938) [465] {233}
Mobile	26,431	26,677	26,854	27,099	27,627 (5,525) [1,326] {663}	28,168 (5,634) [1,352] {676}	28,727 (5,745) [1,379] {689}
Montgomery	16,333	16,446	16,615	17,061	17,395 (3,479) [835] {417}	17,748 (3,550) [852] {426}	18,111 (3,622) [869] {435}
Shelby	16,034	16,186	16,323	16,622	16,978 (3,396) [815] {407}	17,338 (3,468) [832] {416}	17,711 (3,542) [850] {425}
Tuscaloosa	18,947	19,043	19,161	19,288	19,597 (3,919) [941] {470}	19,909 (3,982) [956] {478}	20,212 (4,042) [970] {485}

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.