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

Date: 1/5/21

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 1/5/21 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.

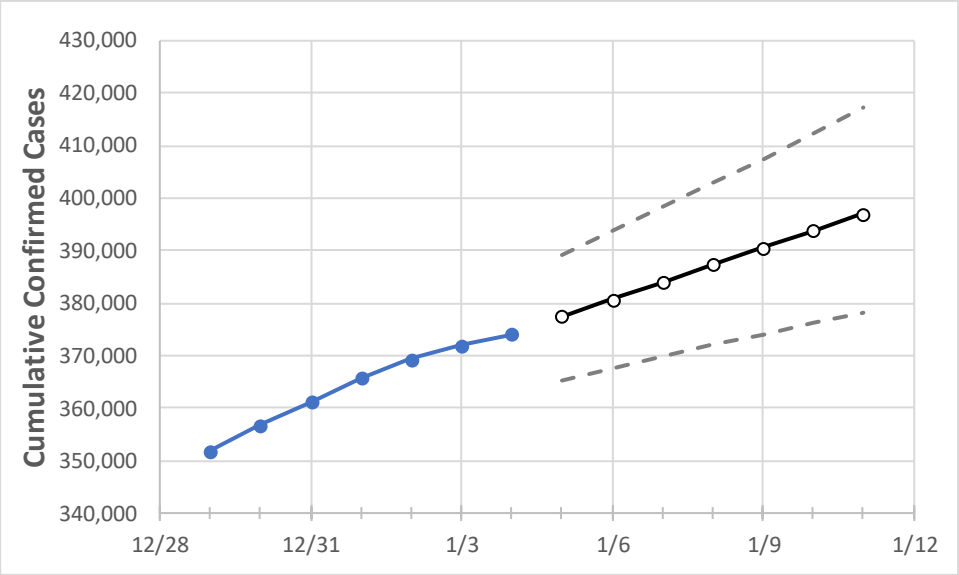
IEM's Modeling Lead

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Alabama	365,747	369,458	371,934	374,095	377,492	380,811	384,086	387,373	390,685	393,937	397,157

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Jefferson	53,058	53,621	54,012	54,349	54,894	55,455	56,022	56,583	57,136	57,692	58,229
Lee	10,450	10,508	10,560	10,656	10,751	10,847	10,945	11,044	11,143	11,245	11,345
Madison	22,590	23,115	23,364	23,563	23,852	24,146	24,431	24,717	25,017	25,307	25,593
Marshall	9,271	9,293	9,314	9,340	9,393	9,444	9,493	9,543	9,593	9,643	9,690
Mobile	26,151	26,431	26,677	26,854	27,108	27,368	27,632	27,905	28,176	28,451	28,735
Montgomery	16,240	16,333	16,446	16,615	16,745	16,869	16,995	17,124	17,251	17,376	17,507
Shelby	15,877	16,034	16,186	16,323	16,484	16,643	16,799	16,959	17,122	17,279	17,434
Tuscaloosa	18,745	18,947	19,043	19,161	19,321	19,486	19,652	19,819	19,980	20,141	20,307

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:		
	1/1	1/2	1/3	1/4	1/6	1/8	1/10
Jefferson	53,058	53,621	54,012	54,349	55,455 (11,091) [2,662] {1,331}	56,583 (11,317) [2,716] {1,358}	57,692 (11,538) [2,769] {1,385}
Lee	10,450	10,508	10,560	10,656	10,847 (2,169) [521] {260}	11,044 (2,209) [530] {265}	11,245 (2,249) [540] {270}
Madison	22,590	23,115	23,364	23,563	24,146 (4,829) [1,159] {580}	24,717 (4,943) [1,186] {593}	25,307 (5,061) [1,215] {607}
Marshall	9,271	9,293	9,314	9,340	9,444 (1,889) [453] {227}	9,543 (1,909) [458] {229}	9,643 (1,929) [463] {231}
Mobile	26,151	26,431	26,677	26,854	27,368 (5,474) [1,314] {657}	27,905 (5,581) [1,339] {670}	28,451 (5,690) [1,366] {683}
Montgomery	16,240	16,333	16,446	16,615	16,869 (3,374) [810] {405}	17,124 (3,425) [822] {411}	17,376 (3,475) [834] {417}
Shelby	15,877	16,034	16,186	16,323	16,643 (3,329) [799] {399}	16,959 (3,392) [814] {407}	17,279 (3,456) [829] {415}
Tuscaloosa	18,745	18,947	19,043	19,161	19,486 (3,897) [935] {468}	19,819 (3,964) [951] {476}	20,141 (4,028) [967] {483}

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.