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

Date: 12/28/20

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 12/28/20 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.

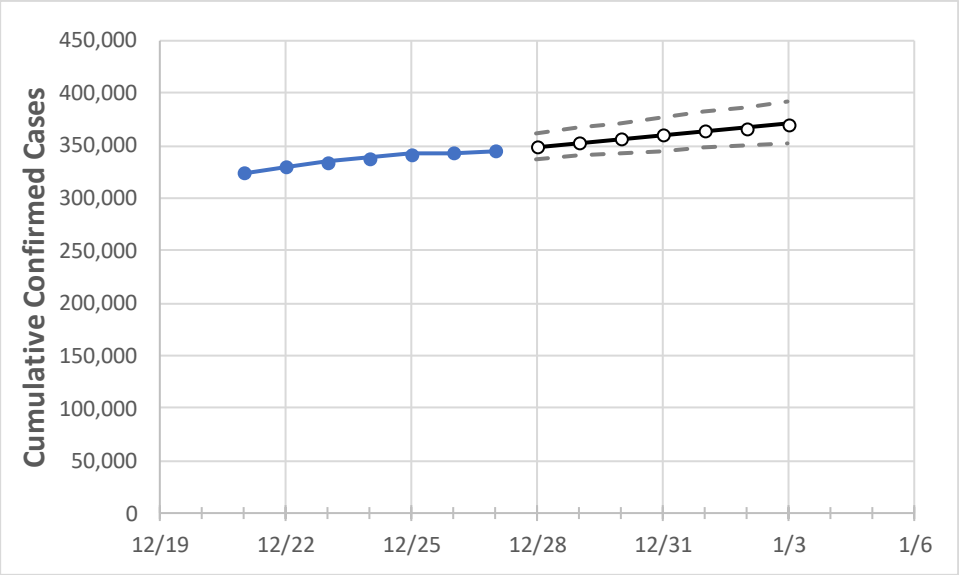
IEM's Modeling Lead

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:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Alabama	338,801	342,426	343,458	345,628	349,141	352,809	356,491	360,178	363,843	367,544	371,200

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 20%, and are often within 10%, of actual confirmed cases.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Jefferson	48,517	49,125	49,278	49,645	50,343	51,030	51,719	52,422	53,126	53,834	54,524
Lee	9,715	9,779	9,800	9,856	9,941	10,031	10,119	10,209	10,305	10,400	10,494
Madison	20,540	20,915	21,038	21,206	21,535	21,865	22,187	22,520	22,852	23,182	23,522
Marshall	8,766	8,820	8,831	8,854	8,915	8,979	9,038	9,097	9,154	9,213	9,267
Mobile	24,325	24,578	24,668	24,933	25,156	25,388	25,625	25,864	26,108	26,358	26,614
Montgomery	15,321	15,419	15,438	15,558	15,696	15,837	15,981	16,126	16,271	16,420	16,571
Shelby	14,635	14,840	14,880	15,020	15,187	15,351	15,520	15,687	15,855	16,024	16,193
Tuscaloosa	17,473	17,635	17,684	17,772	17,940	18,107	18,277	18,445	18,617	18,789	18,962

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:		
	12/24	12/25	12/26	12/27	12/29	12/31	1/2
Jefferson	48,517	49,125	49,278	49,645	51,030 (10,206) [2,449] {1,225}	52,422 (10,484) [2,516] {1,258}	53,834 (10,767) [2,584] {1,292}
Lee	9,715	9,779	9,800	9,856	10,031 (2,006) [482] {241}	10,209 (2,042) [490] {245}	10,400 (2,080) [499] {250}
Madison	20,540	20,915	21,038	21,206	21,865 (4,373) [1,050] {525}	22,520 (4,504) [1,081] {540}	23,182 (4,636) [1,113] {556}
Marshall	8,766	8,820	8,831	8,854	8,979 (1,796) [431] {215}	9,097 (1,819) [437] {218}	9,213 (1,843) [442] {221}
Mobile	24,325	24,578	24,668	24,933	25,388 (5,078) [1,219] {609}	25,864 (5,173) [1,241] {621}	26,358 (5,272) [1,265] {633}
Montgomery	15,321	15,419	15,438	15,558	15,837 (3,167) [760] {380}	16,126 (3,225) [774] {387}	16,420 (3,284) [788] {394}
Shelby	14,635	14,840	14,880	15,020	15,351 (3,070) [737] {368}	15,687 (3,137) [753] {376}	16,024 (3,205) [769] {385}
Tuscaloosa	17,473	17,635	17,684	17,772	18,107 (3,621) [869] {435}	18,445 (3,689) [885] {443}	18,789 (3,758) [902] {451}

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.