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

Date: 1/11/21

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 1/11/21 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.

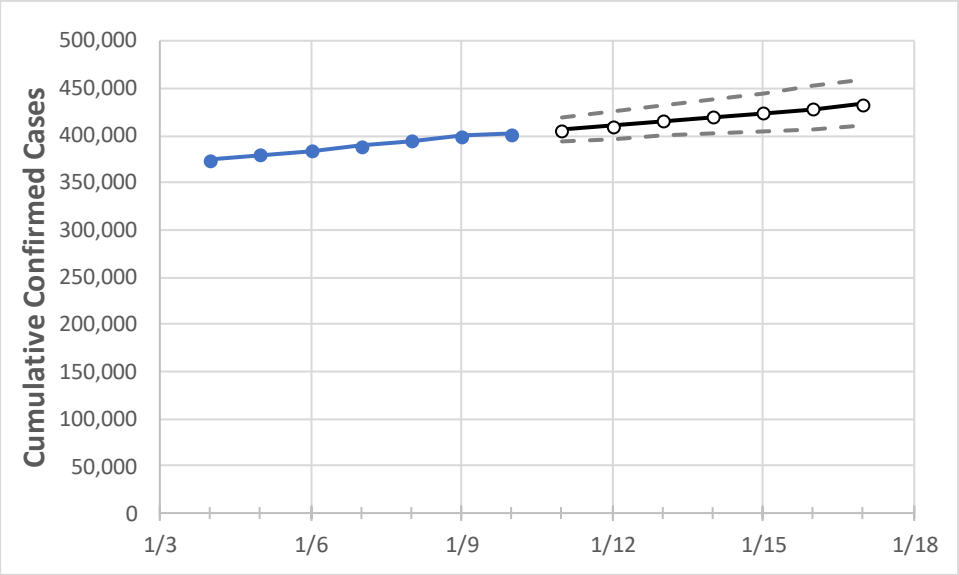
IEM's Modeling Lead

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Alabama	389,230	394,287	399,150	401,900	406,151	410,475	414,874	419,310	423,826	428,379	432,977

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Jefferson	56,823	57,609	58,394	58,896	59,539	60,198	60,876	61,542	62,193	62,834	63,509
Lee	11,179	11,355	11,498	11,565	11,708	11,853	12,007	12,158	12,316	12,479	12,646
Madison	24,395	24,795	25,219	25,463	25,791	26,118	26,444	26,779	27,115	27,455	27,803
Marshall	9,616	9,710	9,819	9,854	9,927	10,001	10,074	10,148	10,223	10,294	10,368
Mobile	27,708	28,034	28,266	28,584	28,888	29,199	29,507	29,826	30,144	30,479	30,819
Montgomery	17,475	17,723	17,916	18,064	18,295	18,529	18,772	19,020	19,272	19,539	19,815
Shelby	17,035	17,253	17,449	17,562	17,755	17,948	18,144	18,343	18,542	18,743	18,946
Tuscaloosa	19,730	19,878	20,062	20,142	20,315	20,482	20,649	20,812	20,975	21,147	21,314

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:		
	1/7	1/8	1/9	1/10	1/12	1/14	1/16
Jefferson	56,823	57,609	58,394	58,896	60,198 (12,040) [2,890] {1,445}	61,542 (12,308) [2,954] {1,477}	62,834 (12,567) [3,016] {1,508}
Lee	11,179	11,355	11,498	11,565	11,853 (2,371) [569] {284}	12,158 (2,432) [584] {292}	12,479 (2,496) [599] {300}
Madison	24,395	24,795	25,219	25,463	26,118 (5,224) [1,254] {627}	26,779 (5,356) [1,285] {643}	27,455 (5,491) [1,318] {659}
Marshall	9,616	9,710	9,819	9,854	10,001 (2,000) [480] {240}	10,148 (2,030) [487] {244}	10,294 (2,059) [494] {247}
Mobile	27,708	28,034	28,266	28,584	29,199 (5,840) [1,402] {701}	29,826 (5,965) [1,432] {716}	30,479 (6,096) [1,463] {731}
Montgomery	17,475	17,723	17,916	18,064	18,529 (3,706) [889] {445}	19,020 (3,804) [913] {456}	19,539 (3,908) [938] {469}
Shelby	17,035	17,253	17,449	17,562	17,948 (3,590) [862] {431}	18,343 (3,669) [880] {440}	18,743 (3,749) [900] {450}
Tuscaloosa	19,730	19,878	20,062	20,142	20,482 (4,096) [983] {492}	20,812 (4,162) [999] {499}	21,147 (4,229) [1,015] {508}

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.