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

Date: 1/14/21

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 1/14/21 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.

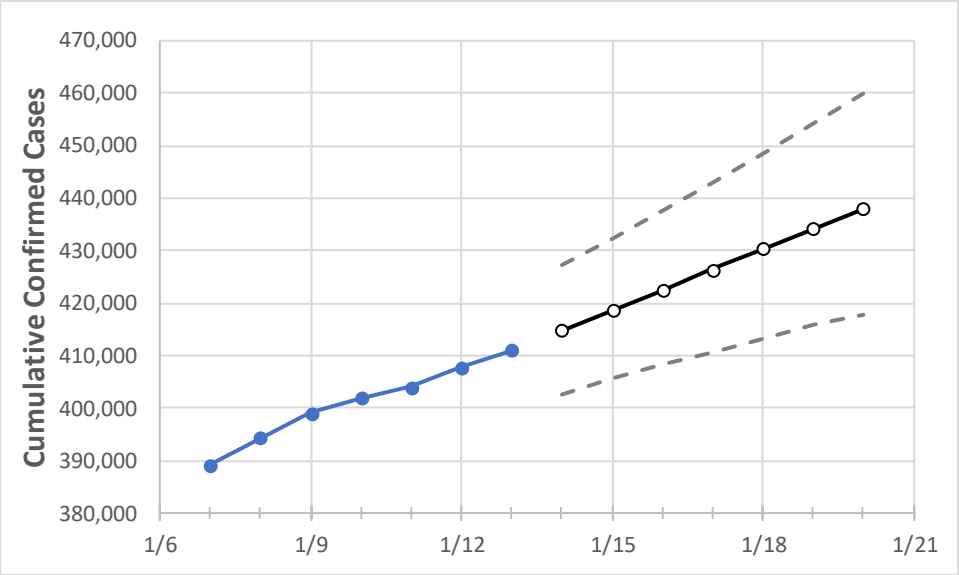
IEM's Modeling Lead

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Alabama	401,900	404,000	407,848	410,995	414,880	418,679	422,556	426,543	430,379	434,213	437,981

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Jefferson	58,896	59,248	59,867	60,269	60,869	61,467	62,059	62,662	63,254	63,838	64,404
Lee	11,565	11,626	11,812	11,983	12,131	12,280	12,435	12,597	12,764	12,935	13,110
Madison	25,463	25,643	26,012	26,190	26,484	26,779	27,070	27,357	27,653	27,938	28,221
Marshall	9,854	9,863	9,907	9,988	10,051	10,113	10,176	10,240	10,301	10,362	10,423
Mobile	28,584	28,793	29,011	29,334	29,619	29,913	30,209	30,509	30,812	31,117	31,429
Montgomery	18,064	18,176	18,315	18,405	18,592	18,776	18,970	19,168	19,364	19,564	19,764
Shelby	17,562	17,690	17,837	18,000	18,174	18,345	18,517	18,688	18,860	19,032	19,202
Tuscaloosa	20,142	20,211	20,320	20,449	20,588	20,722	20,855	20,989	21,122	21,253	21,376

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:		
	1/10	1/11	1/12	1/13	1/15	1/17	1/19
Jefferson	58,896	59,248	59,867	60,269	61,467 (12,293) [2,950] {1,475}	62,662 (12,532) [3,008] {1,504}	63,838 (12,768) [3,064] {1,532}
Lee	11,565	11,626	11,812	11,983	12,280 (2,456) [589] {295}	12,597 (2,519) [605] {302}	12,935 (2,587) [621] {310}
Madison	25,463	25,643	26,012	26,190	26,779 (5,356) [1,285] {643}	27,357 (5,471) [1,313] {657}	27,938 (5,588) [1,341] {671}
Marshall	9,854	9,863	9,907	9,988	10,113 (2,023) [485] {243}	10,240 (2,048) [491] {246}	10,362 (2,072) [497] {249}
Mobile	28,584	28,793	29,011	29,334	29,913 (5,983) [1,436] {718}	30,509 (6,102) [1,464] {732}	31,117 (6,223) [1,494] {747}
Montgomery	18,064	18,176	18,315	18,405	18,776 (3,755) [901] {451}	19,168 (3,834) [920] {460}	19,564 (3,913) [939] {470}
Shelby	17,562	17,690	17,837	18,000	18,345 (3,669) [881] {440}	18,688 (3,738) [897] {449}	19,032 (3,806) [914] {457}
Tuscaloosa	20,142	20,211	20,320	20,449	20,722 (4,144) [995] {497}	20,989 (4,198) [1,007] {504}	21,253 (4,251) [1,020] {510}

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.