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

Date: 1/25/21

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 1/25/21 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.

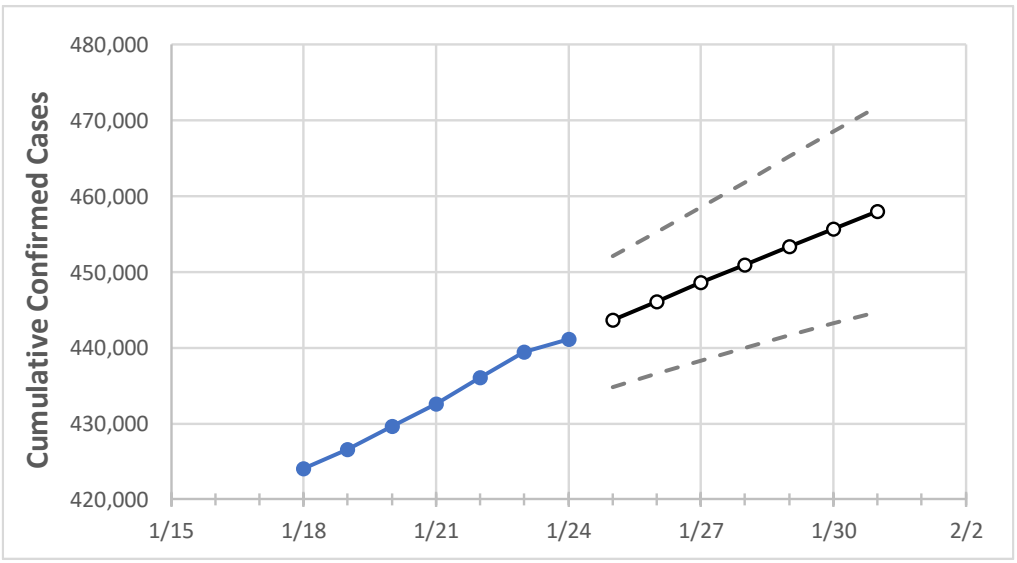
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Alabama	432,536	436,087	439,442	441,170	443,638	446,102	448,589	450,935	453,306	455,660	457,932

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Jefferson	63,523	63,969	64,437	64,681	65,036	65,384	65,723	66,033	66,355	66,660	66,970
Lee	12,901	13,036	13,137	13,205	13,317	13,434	13,549	13,667	13,780	13,891	14,004
Madison	27,627	27,851	28,158	28,310	28,482	28,657	28,833	29,004	29,169	29,339	29,502
Marshall	10,322	10,357	10,420	10,471	10,511	10,550	10,588	10,626	10,662	10,697	10,732
Mobile	30,967	31,211	31,435	31,620	31,818	32,013	32,205	32,394	32,585	32,772	32,955
Montgomery	19,495	19,698	19,873	19,954	20,082	20,206	20,336	20,461	20,584	20,706	20,829
Shelby	18,941	19,093	19,248	19,335	19,446	19,555	19,662	19,767	19,872	19,971	20,070
Tuscaloosa	21,122	21,233	21,492	21,525	21,615	21,700	21,784	21,867	21,953	22,036	22,116

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:		
	1/21	1/22	1/23	1/24	1/26	1/28	1/30
Jefferson	63,523	63,969	64,437	64,681	65,384 (13,077) [3,138] {1,569}	66,033 (13,207) [3,170] {1,585}	66,660 (13,332) [3,200] {1,600}
Lee	12,901	13,036	13,137	13,205	13,434 (2,687) [645] {322}	13,667 (2,733) [656] {328}	13,891 (2,778) [667] {333}
Madison	27,627	27,851	28,158	28,310	28,657 (5,731) [1,376] {688}	29,004 (5,801) [1,392] {696}	29,339 (5,868) [1,408] {704}
Marshall	10,322	10,357	10,420	10,471	10,550 (2,110) [506] {253}	10,626 (2,125) [510] {255}	10,697 (2,139) [513] {257}
Mobile	30,967	31,211	31,435	31,620	32,013 (6,403) [1,537] {768}	32,394 (6,479) [1,555] {777}	32,772 (6,554) [1,573] {787}
Montgomery	19,495	19,698	19,873	19,954	20,206 (4,041) [970] {485}	20,461 (4,092) [982] {491}	20,706 (4,141) [994] {497}
Shelby	18,941	19,093	19,248	19,335	19,555 (3,911) [939] {469}	19,767 (3,953) [949] {474}	19,971 (3,994) [959] {479}
Tuscaloosa	21,122	21,233	21,492	21,525	21,700 (4,340) [1,042] {521}	21,867 (4,373) [1,050] {525}	22,036 (4,407) [1,058] {529}

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.