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

Date: 2/25/22

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 2/25/22 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.

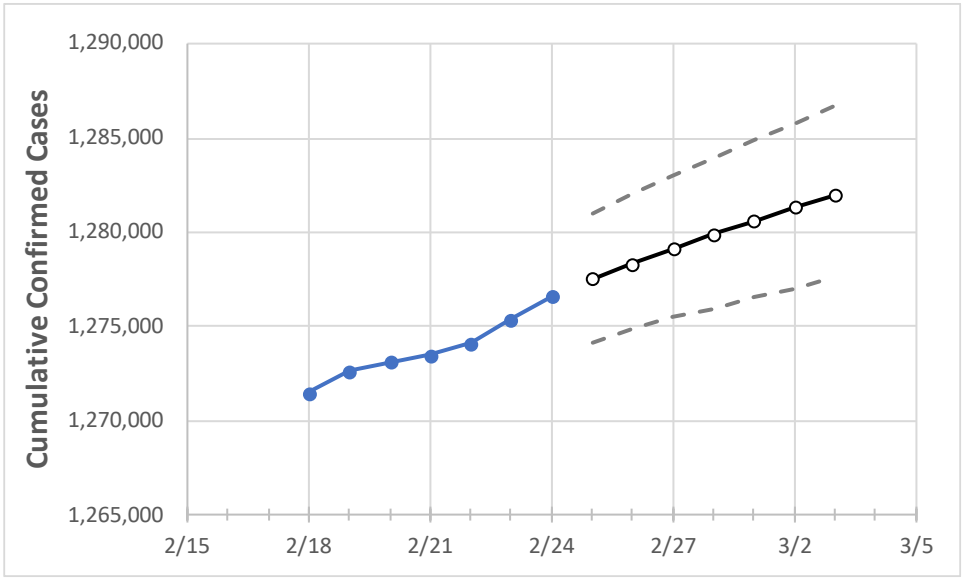
IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Alabama	1,273,484	1,274,123	1,275,355	1,276,580	1,277,561	1,278,316	1,279,105	1,279,884	1,280,594	1,281,325	1,281,944

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Jefferson	181,366	181,455	181,521	181,577	181,658	181,744	181,805	181,876	181,942	182,000	182,063
Lee	37,447	37,454	37,472	37,484	37,504	37,520	37,537	37,552	37,567	37,584	37,596
Madison	87,650	87,672	87,846	87,935	88,018	88,100	88,174	88,249	88,315	88,387	88,452
Marshall	27,047	27,053	27,068	27,078	27,089	27,099	27,108	27,116	27,125	27,132	27,139
Mobile	111,383	111,461	111,585	111,753	111,831	111,907	111,973	112,040	112,108	112,175	112,230
Montgomery	54,150	54,204	54,240	54,265	54,293	54,318	54,342	54,364	54,387	54,406	54,426
Shelby	58,531	58,556	58,605	58,646	58,678	58,710	58,740	58,771	58,796	58,821	58,848
Tuscaloosa	54,149	54,165	54,247	54,354	54,426	54,486	54,550	54,606	54,671	54,729	54,785

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:		
	2/21	2/22	2/23	2/24	2/26	2/28	3/2
Jefferson	181,366	181,455	181,521	181,577	181,744 (36,349) [8,724] {4,362}	181,876 (36,375) [8,730] {4,365}	182,000 (36,400) [8,736] {4,368}
Lee	37,447	37,454	37,472	37,484	37,520 (7,504) [1,801] {900}	37,552 (7,510) [1,802] {901}	37,584 (7,517) [1,804] {902}
Madison	87,650	87,672	87,846	87,935	88,100 (17,620) [4,229] {2,114}	88,249 (17,650) [4,236] {2,118}	88,387 (17,677) [4,243] {2,121}
Marshall	27,047	27,053	27,068	27,078	27,099 (5,420) [1,301] {650}	27,116 (5,423) [1,302] {651}	27,132 (5,426) [1,302] {651}
Mobile	111,383	111,461	111,585	111,753	111,907 (22,381) [5,372] {2,686}	112,040 (22,408) [5,378] {2,689}	112,175 (22,435) [5,384] {2,692}
Montgomery	54,150	54,204	54,240	54,265	54,318 (10,864) [2,607] {1,304}	54,364 (10,873) [2,609] {1,305}	54,406 (10,881) [2,611] {1,306}
Shelby	58,531	58,556	58,605	58,646	58,710 (11,742) [2,818] {1,409}	58,771 (11,754) [2,821] {1,410}	58,821 (11,764) [2,823] {1,412}
Tuscaloosa	54,149	54,165	54,247	54,354	54,486 (10,897) [2,615] {1,308}	54,606 (10,921) [2,621] {1,311}	54,729 (10,946) [2,627] {1,313}

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.