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

Date: 4/5/21

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 4/5/21 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.

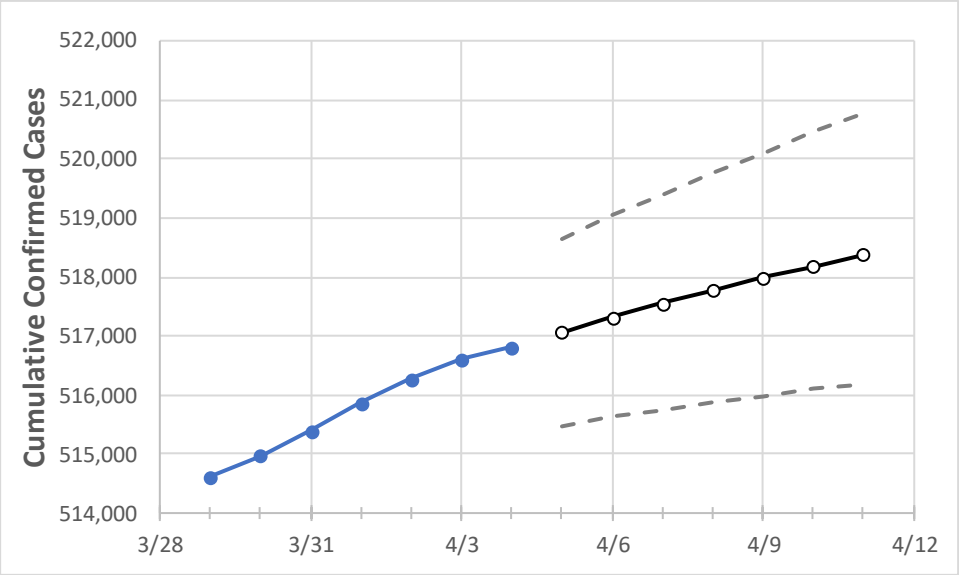
IEM's Modeling Lead

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Alabama	515,866	516,266	516,615	516,809	517,069	517,322	517,562	517,779	517,996	518,185	518,383

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Jefferson	74,789	74,855	74,917	74,942	74,992	75,036	75,082	75,125	75,163	75,203	75,239
Lee	15,433	15,444	15,452	15,457	15,467	15,478	15,487	15,497	15,507	15,517	15,526
Madison	33,577	33,619	33,646	33,660	33,687	33,713	33,740	33,767	33,792	33,816	33,842
Marshall	11,865	11,877	11,885	11,888	11,890	11,892	11,894	11,896	11,897	11,899	11,900
Mobile	37,515	37,555	37,574	37,590	37,608	37,625	37,642	37,658	37,674	37,688	37,702
Montgomery	23,779	23,800	23,823	23,834	23,858	23,881	23,905	23,928	23,950	23,974	23,995
Shelby	23,077	23,097	23,106	23,116	23,132	23,147	23,162	23,176	23,190	23,204	23,217
Tuscaloosa	25,082	25,096	25,149	25,179	25,202	25,225	25,247	25,268	25,290	25,311	25,332

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:		
	4/1	4/2	4/3	4/4	4/6	4/8	4/10
Jefferson	74,789	74,855	74,917	74,942	75,036 (15,007) [3,602] {1,801}	75,125 (15,025) [3,606] {1,803}	75,203 (15,041) [3,610] {1,805}
Lee	15,433	15,444	15,452	15,457	15,478 (3,096) [743] {371}	15,497 (3,099) [744] {372}	15,517 (3,103) [745] {372}
Madison	33,577	33,619	33,646	33,660	33,713 (6,743) [1,618] {809}	33,767 (6,753) [1,621] {810}	33,816 (6,763) [1,623] {812}
Marshall	11,865	11,877	11,885	11,888	11,892 (2,378) [571] {285}	11,896 (2,379) [571] {286}	11,899 (2,380) [571] {286}
Mobile	37,515	37,555	37,574	37,590	37,625 (7,525) [1,806] {903}	37,658 (7,532) [1,808] {904}	37,688 (7,538) [1,809] {905}
Montgomery	23,779	23,800	23,823	23,834	23,881 (4,776) [1,146] {573}	23,928 (4,786) [1,149] {574}	23,974 (4,795) [1,151] {575}
Shelby	23,077	23,097	23,106	23,116	23,147 (4,629) [1,111] {556}	23,176 (4,635) [1,112] {556}	23,204 (4,641) [1,114] {557}
Tuscaloosa	25,082	25,096	25,149	25,179	25,225 (5,045) [1,211] {605}	25,268 (5,054) [1,213] {606}	25,311 (5,062) [1,215] {607}

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.