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

Date: 3/4/21

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 3/4/21 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.

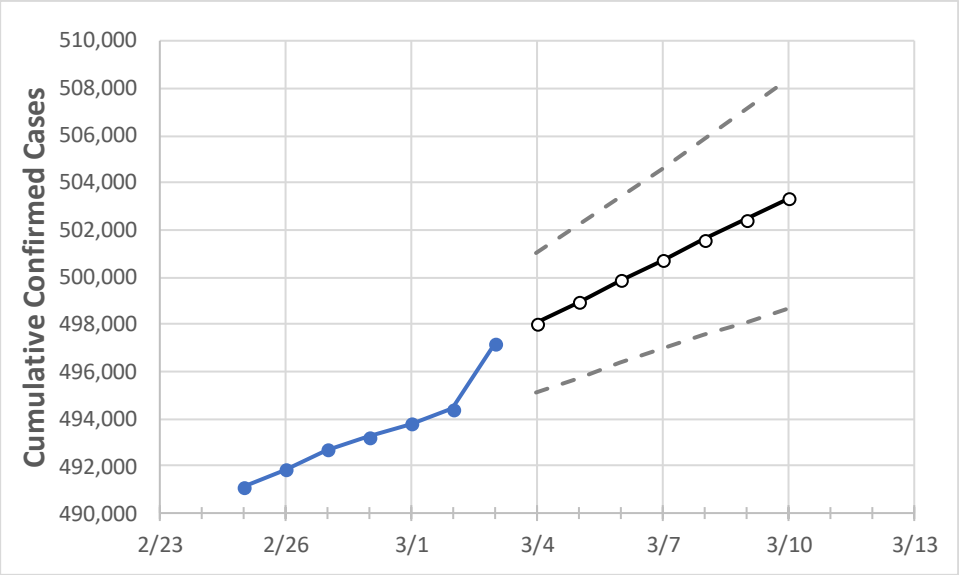
IEM's Modeling Lead

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Alabama	493,252	493,769	494,421	497,154	498,051	498,946	499,845	500,724	501,581	502,450	503,311

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Jefferson	70,986	71,073	71,145	71,400	71,504	71,606	71,708	71,811	71,916	72,020	72,120
Lee	14,961	14,967	14,980	15,021	15,037	15,053	15,068	15,083	15,097	15,111	15,123
Madison	32,405	32,425	32,457	32,573	32,621	32,667	32,712	32,755	32,797	32,838	32,878
Marshall	11,261	11,262	11,269	11,439	11,469	11,501	11,534	11,570	11,609	11,651	11,694
Mobile	36,108	36,139	36,184	36,252	36,321	36,391	36,458	36,522	36,588	36,650	36,713
Montgomery	22,565	22,586	22,636	22,708	22,741	22,773	22,804	22,834	22,866	22,895	22,924
Shelby	21,929	21,968	22,020	22,112	22,156	22,200	22,242	22,284	22,325	22,366	22,407
Tuscaloosa	24,110	24,184	24,213	24,289	24,331	24,374	24,414	24,455	24,496	24,535	24,575

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:		
	2/28	3/1	3/2	3/3	3/5	3/7	3/9
Jefferson	70,986	71,073	71,145	71,400	71,606 (14,321) [3,437] {1,719}	71,811 (14,362) [3,447] {1,723}	72,020 (14,404) [3,457] {1,728}
Lee	14,961	14,967	14,980	15,021	15,053 (3,011) [723] {361}	15,083 (3,017) [724] {362}	15,111 (3,022) [725] {363}
Madison	32,405	32,425	32,457	32,573	32,667 (6,533) [1,568] {784}	32,755 (6,551) [1,572] {786}	32,838 (6,568) [1,576] {788}
Marshall	11,261	11,262	11,269	11,439	11,501 (2,300) [552] {276}	11,570 (2,314) [555] {278}	11,651 (2,330) [559] {280}
Mobile	36,108	36,139	36,184	36,252	36,391 (7,278) [1,747] {873}	36,522 (7,304) [1,753] {877}	36,650 (7,330) [1,759] {880}
Montgomery	22,565	22,586	22,636	22,708	22,773 (4,555) [1,093] {547}	22,834 (4,567) [1,096] {548}	22,895 (4,579) [1,099] {549}
Shelby	21,929	21,968	22,020	22,112	22,200 (4,440) [1,066] {533}	22,284 (4,457) [1,070] {535}	22,366 (4,473) [1,074] {537}
Tuscaloosa	24,110	24,184	24,213	24,289	24,374 (4,875) [1,170] {585}	24,455 (4,891) [1,174] {587}	24,535 (4,907) [1,178] {589}

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.