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

Date: 12/6/21

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 12/6/21 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.

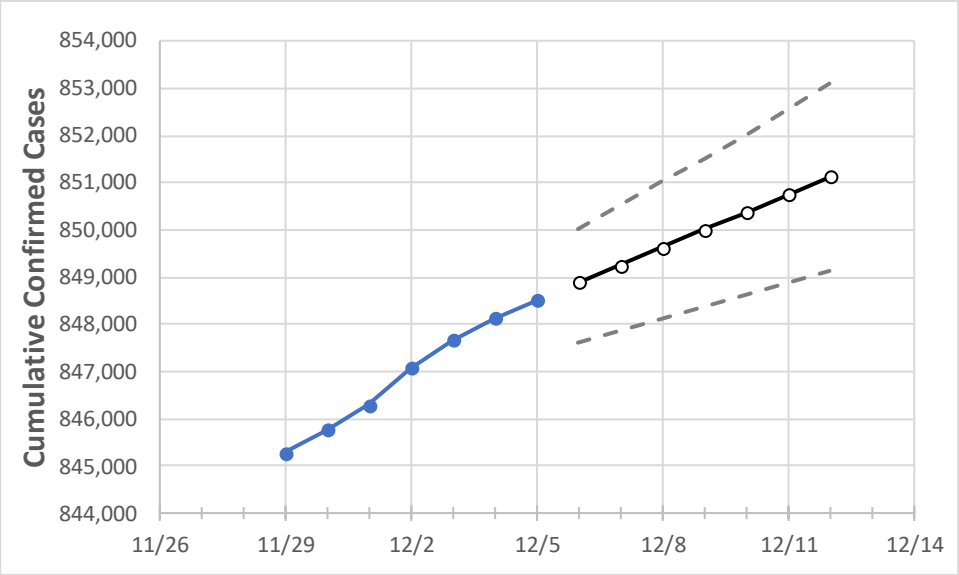
IEM's Modeling Lead

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Alabama	847,064	847,659	848,137	848,498	848,880	849,249	849,617	850,004	850,369	850,751	851,121

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Jefferson	116,370	116,375	116,405	116,429	116,462	116,498	116,531	116,564	116,600	116,635	116,675
Lee	25,639	25,664	25,655	25,677	25,696	25,718	25,739	25,762	25,784	25,809	25,833
Madison	53,394	53,434	53,497	53,544	53,572	53,602	53,630	53,659	53,684	53,718	53,744
Marshall	18,812	18,821	18,846	18,859	18,870	18,881	18,892	18,903	18,915	18,928	18,940
Mobile	74,300	74,337	74,368	74,396	74,417	74,437	74,457	74,476	74,497	74,516	74,535
Montgomery	34,535	34,571	34,562	34,570	34,582	34,593	34,604	34,616	34,627	34,638	34,651
Shelby	38,395	38,413	38,435	38,446	38,457	38,469	38,481	38,493	38,504	38,515	38,526
Tuscaloosa	36,096	36,131	36,152	36,168	36,187	36,204	36,223	36,240	36,259	36,277	36,295

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:											
	12/2	12/3	12/4	12/5	12/7				12/9				12/11			
Jefferson	116,370	116,375	116,405	116,429	116,498	(23,300)	[5,592]	{2,796}	116,564	(23,313)	[5,595]	{2,798}	116,635	(23,327)	[5,598]	{2,799}
Lee	25,639	25,664	25,655	25,677	25,718	(5,144)	[1,234]	{617}	25,762	(5,152)	[1,237]	{618}	25,809	(5,162)	[1,239]	{619}
Madison	53,394	53,434	53,497	53,544	53,602	(10,720)	[2,573]	{1,286}	53,659	(10,732)	[2,576]	{1,288}	53,718	(10,744)	[2,578]	{1,289}
Marshall	18,812	18,821	18,846	18,859	18,881	(3,776)	[906]	{453}	18,903	(3,781)	[907]	{454}	18,928	(3,786)	[909]	{454}
Mobile	74,300	74,337	74,368	74,396	74,437	(14,887)	[3,573]	{1,786}	74,476	(14,895)	[3,575]	{1,787}	74,516	(14,903)	[3,577]	{1,788}
Montgomery	34,535	34,571	34,562	34,570	34,593	(6,919)	[1,660]	{830}	34,616	(6,923)	[1,662]	{831}	34,638	(6,928)	[1,663]	{831}
Shelby	38,395	38,413	38,435	38,446	38,469	(7,694)	[1,847]	{923}	38,493	(7,699)	[1,848]	{924}	38,515	(7,703)	[1,849]	{924}
Tuscaloosa	36,096	36,131	36,152	36,168	36,204	(7,241)	[1,738]	{869}	36,240	(7,248)	[1,740]	{870}	36,277	(7,255)	[1,741]	{871}

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.