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

Date: 12/20/21

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 12/20/21 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.

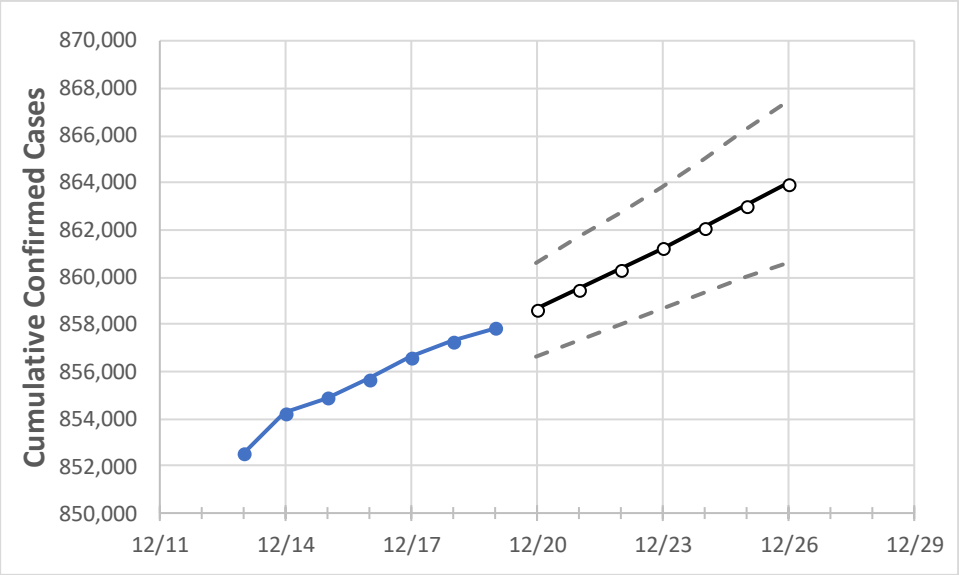
IEM's Modeling Lead

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:						
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26
Alabama	855,692	856,600	857,292	857,844	858,653	859,469	860,323	861,205	862,108	863,027	863,974

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:						
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26
Jefferson	117,170	117,304	117,421	117,532	117,662	117,790	117,932	118,082	118,237	118,400	118,580
Lee	25,880	25,894	25,912	25,924	25,948	25,971	25,995	26,020	26,046	26,070	26,097
Madison	54,233	54,302	54,377	54,436	54,524	54,613	54,704	54,802	54,904	55,007	55,117
Marshall	19,005	19,053	19,062	19,071	19,091	19,112	19,133	19,154	19,177	19,201	19,226
Mobile	74,783	74,827	74,869	74,899	74,938	74,977	75,014	75,056	75,096	75,138	75,180
Montgomery	34,875	34,910	34,946	34,971	35,015	35,063	35,111	35,162	35,216	35,274	35,331
Shelby	38,794	38,857	38,889	38,921	38,966	39,014	39,063	39,114	39,169	39,223	39,280
Tuscaloosa	36,492	36,515	36,535	36,542	36,571	36,600	36,629	36,658	36,689	36,719	36,752

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:											
	12/16	12/17	12/18	12/19	12/21				12/23				12/25			
Jefferson	117,170	117,304	117,421	117,532	117,790	(23,558)	[5,654]	{2,827}	118,082	(23,616)	[5,668]	{2,834}	118,400	(23,680)	[5,683]	{2,842}
Lee	25,880	25,894	25,912	25,924	25,971	(5,194)	[1,247]	{623}	26,020	(5,204)	[1,249]	{624}	26,070	(5,214)	[1,251]	{626}
Madison	54,233	54,302	54,377	54,436	54,613	(10,923)	[2,621]	{1,311}	54,802	(10,960)	[2,630]	{1,315}	55,007	(11,001)	[2,640]	{1,320}
Marshall	19,005	19,053	19,062	19,071	19,112	(3,822)	[917]	{459}	19,154	(3,831)	[919]	{460}	19,201	(3,840)	[922]	{461}
Mobile	74,783	74,827	74,869	74,899	74,977	(14,995)	[3,599]	{1,799}	75,056	(15,011)	[3,603]	{1,801}	75,138	(15,028)	[3,607]	{1,803}
Montgomery	34,875	34,910	34,946	34,971	35,063	(7,013)	[1,683]	{842}	35,162	(7,032)	[1,688]	{844}	35,274	(7,055)	[1,693]	{847}
Shelby	38,794	38,857	38,889	38,921	39,014	(7,803)	[1,873]	{936}	39,114	(7,823)	[1,877]	{939}	39,223	(7,845)	[1,883]	{941}
Tuscaloosa	36,492	36,515	36,535	36,542	36,600	(7,320)	[1,757]	{878}	36,658	(7,332)	[1,760]	{880}	36,719	(7,344)	[1,763]	{881}

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.