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

Date: 12/13/21

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 12/13/21 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.

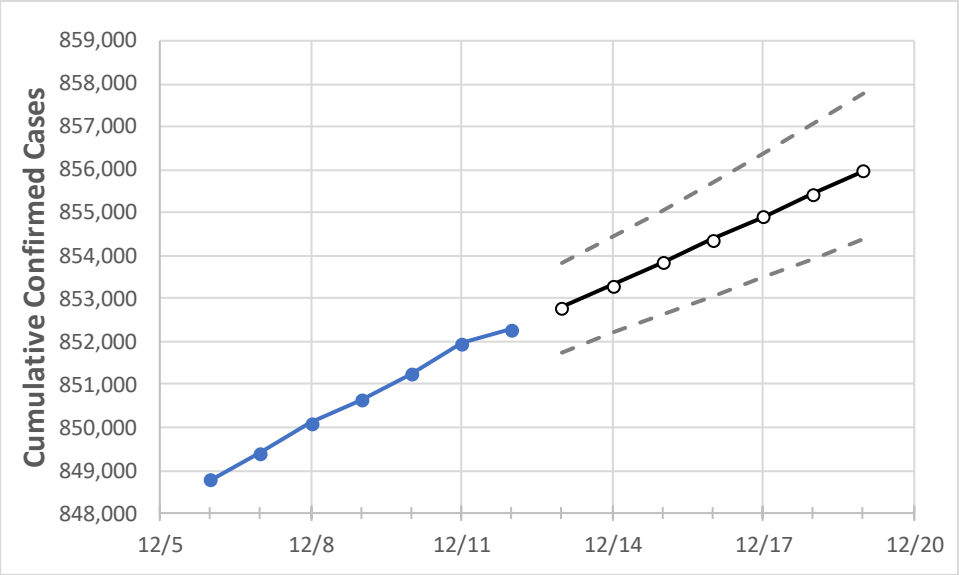
IEM's Modeling Lead

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Alabama	850,645	851,237	851,950	852,280	852,798	853,313	853,850	854,376	854,911	855,443	855,983

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Jefferson	116,530	116,555	116,616	116,659	116,702	116,741	116,786	116,827	116,872	116,916	116,960
Lee	25,729	25,745	25,761	25,770	25,793	25,815	25,838	25,862	25,886	25,911	25,936
Madison	53,756	53,813	53,880	53,917	53,967	54,018	54,072	54,126	54,178	54,236	54,294
Marshall	18,908	18,924	18,938	18,941	18,955	18,969	18,983	18,998	19,012	19,029	19,045
Mobile	74,565	74,591	74,617	74,629	74,657	74,685	74,713	74,740	74,767	74,795	74,821
Montgomery	34,616	34,642	34,669	34,683	34,702	34,722	34,742	34,762	34,783	34,805	34,827
Shelby	38,530	38,558	38,593	38,615	38,637	38,660	38,682	38,705	38,728	38,752	38,776
Tuscaloosa	36,279	36,310	36,351	36,368	36,394	36,419	36,443	36,471	36,496	36,525	36,550

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:											
	12/9	12/10	12/11	12/12	12/14				12/16				12/18			
Jefferson	116,530	116,555	116,616	116,659	116,741	(23,348)	[5,604]	{2,802}	116,827	(23,365)	[5,608]	{2,804}	116,916	(23,383)	[5,612]	{2,806}
Lee	25,729	25,745	25,761	25,770	25,815	(5,163)	[1,239]	{620}	25,862	(5,172)	[1,241]	{621}	25,911	(5,182)	[1,244]	{622}
Madison	53,756	53,813	53,880	53,917	54,018	(10,804)	[2,593]	{1,296}	54,126	(10,825)	[2,598]	{1,299}	54,236	(10,847)	[2,603]	{1,302}
Marshall	18,908	18,924	18,938	18,941	18,969	(3,794)	[910]	{455}	18,998	(3,800)	[912]	{456}	19,029	(3,806)	[913]	{457}
Mobile	74,565	74,591	74,617	74,629	74,685	(14,937)	[3,585]	{1,792}	74,740	(14,948)	[3,588]	{1,794}	74,795	(14,959)	[3,590]	{1,795}
Montgomery	34,616	34,642	34,669	34,683	34,722	(6,944)	[1,667]	{833}	34,762	(6,952)	[1,669]	{834}	34,805	(6,961)	[1,671]	{835}
Shelby	38,530	38,558	38,593	38,615	38,660	(7,732)	[1,856]	{928}	38,705	(7,741)	[1,858]	{929}	38,752	(7,750)	[1,860]	{930}
Tuscaloosa	36,279	36,310	36,351	36,368	36,419	(7,284)	[1,748]	{874}	36,471	(7,294)	[1,751]	{875}	36,525	(7,305)	[1,753]	{877}

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.