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

Date: 12/21/20

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 12/21/20 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.

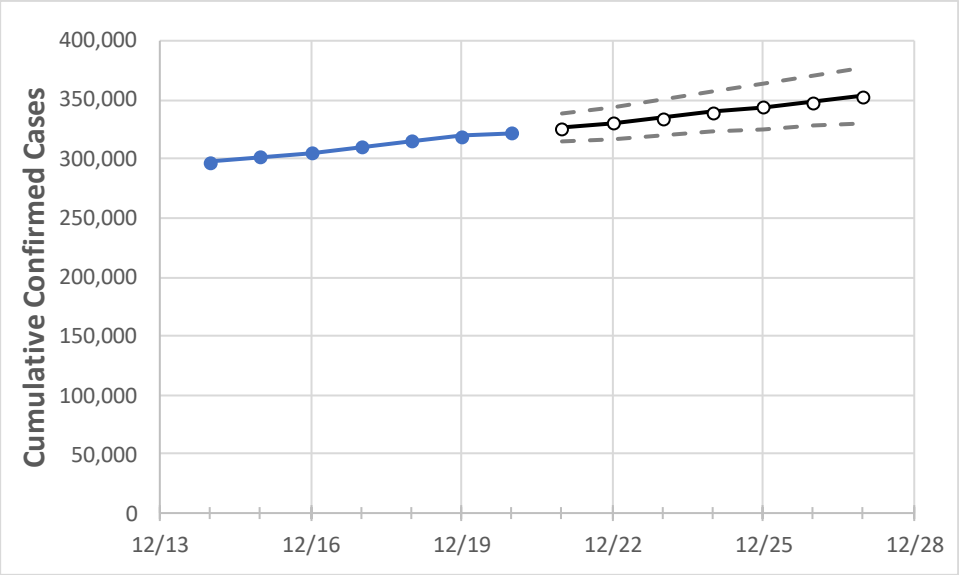
IEM's Modeling Lead

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:						
	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Alabama	310,335	315,683	319,904	322,452	326,628	330,878	335,202	339,600	344,073	348,622	353,246

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 20%, and are often within 10%, of actual confirmed cases.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Jefferson	43,318	44,274	45,092	45,527	46,300	47,092	47,902	48,731	49,579	50,446	51,332
Lee	9,055	9,188	9,283	9,337	9,439	9,544	9,653	9,765	9,881	10,000	10,124
Madison	18,184	18,684	19,062	19,314	19,674	20,044	20,423	20,812	21,210	21,618	22,037
Marshall	8,141	8,233	8,324	8,380	8,460	8,540	8,619	8,698	8,776	8,853	8,930
Mobile	22,829	23,078	23,224	23,463	23,667	23,876	24,091	24,312	24,538	24,771	25,009
Montgomery	14,320	14,532	14,695	14,775	14,936	15,102	15,275	15,455	15,640	15,833	16,033
Shelby	13,366	13,586	13,763	13,888	14,065	14,244	14,425	14,608	14,792	14,978	15,167
Tuscaloosa	16,165	16,378	16,565	16,663	16,854	17,047	17,243	17,441	17,642	17,845	18,051

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:		
	12/17	12/18	12/19	12/20	12/22	12/24	12/26
Jefferson	43,318	44,274	45,092	45,527	47,092 (9,418) [2,260] {1,130}	48,731 (9,746) [2,339] {1,170}	50,446 (10,089) [2,421] {1,211}
Lee	9,055	9,188	9,283	9,337	9,544 (1,909) [458] {229}	9,765 (1,953) [469] {234}	10,000 (2,000) [480] {240}
Madison	18,184	18,684	19,062	19,314	20,044 (4,009) [962] {481}	20,812 (4,162) [999] {499}	21,618 (4,324) [1,038] {519}
Marshall	8,141	8,233	8,324	8,380	8,540 (1,708) [410] {205}	8,698 (1,740) [417] {209}	8,853 (1,771) [425] {212}
Mobile	22,829	23,078	23,224	23,463	23,876 (4,775) [1,146] {573}	24,312 (4,862) [1,167] {583}	24,771 (4,954) [1,189] {594}
Montgomery	14,320	14,532	14,695	14,775	15,102 (3,020) [725] {362}	15,455 (3,091) [742] {371}	15,833 (3,167) [760] {380}
Shelby	13,366	13,586	13,763	13,888	14,244 (2,849) [684] {342}	14,608 (2,922) [701] {351}	14,978 (2,996) [719] {359}
Tuscaloosa	16,165	16,378	16,565	16,663	17,047 (3,409) [818] {409}	17,441 (3,488) [837] {419}	17,845 (3,569) [857] {428}

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.