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

Date: 2/16/21

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 2/16/21 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.

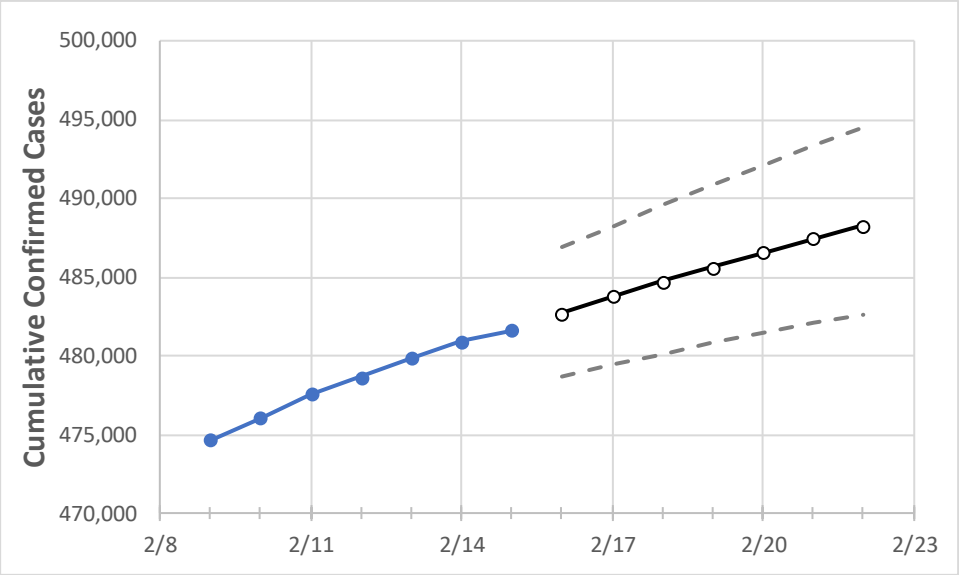
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Alabama	478,667	479,856	480,931	481,605	482,693	483,746	484,723	485,637	486,557	487,432	488,280

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Jefferson	69,253	69,364	69,514	69,599	69,724	69,839	69,949	70,053	70,156	70,249	70,342
Lee	14,524	14,563	14,608	14,622	14,661	14,699	14,735	14,769	14,803	14,836	14,867
Madison	31,312	31,432	31,538	31,593	31,694	31,791	31,886	31,980	32,072	32,159	32,249
Marshall	11,068	11,090	11,102	11,105	11,122	11,138	11,153	11,169	11,183	11,198	11,211
Mobile	34,645	34,762	34,840	34,951	35,051	35,151	35,244	35,333	35,418	35,502	35,583
Montgomery	21,858	21,909	21,973	22,008	22,063	22,116	22,167	22,218	22,267	22,313	22,359
Shelby	21,164	21,217	21,277	21,326	21,383	21,438	21,492	21,544	21,593	21,641	21,688
Tuscaloosa	23,366	23,414	23,476	23,505	23,563	23,621	23,674	23,729	23,780	23,832	23,879

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Jefferson	69,253	69,364	69,514	69,599	69,839 (13,968) [3,352] {1,676}	70,053 (14,011) [3,363] {1,681}	70,249 (14,050) [3,372] {1,686}
Lee	14,524	14,563	14,608	14,622	14,699 (2,940) [706] {353}	14,769 (2,954) [709] {354}	14,836 (2,967) [712] {356}
Madison	31,312	31,432	31,538	31,593	31,791 (6,358) [1,526] {763}	31,980 (6,396) [1,535] {768}	32,159 (6,432) [1,544] {772}
Marshall	11,068	11,090	11,102	11,105	11,138 (2,228) [535] {267}	11,169 (2,234) [536] {268}	11,198 (2,240) [537] {269}
Mobile	34,645	34,762	34,840	34,951	35,151 (7,030) [1,687] {844}	35,333 (7,067) [1,696] {848}	35,502 (7,100) [1,704] {852}
Montgomery	21,858	21,909	21,973	22,008	22,116 (4,423) [1,062] {531}	22,218 (4,444) [1,066] {533}	22,313 (4,463) [1,071] {536}
Shelby	21,164	21,217	21,277	21,326	21,438 (4,288) [1,029] {515}	21,544 (4,309) [1,034] {517}	21,641 (4,328) [1,039] {519}
Tuscaloosa	23,366	23,414	23,476	23,505	23,621 (4,724) [1,134] {567}	23,729 (4,746) [1,139] {569}	23,832 (4,766) [1,144] {572}

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.