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

Date: 2/23/21

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 2/23/21 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.

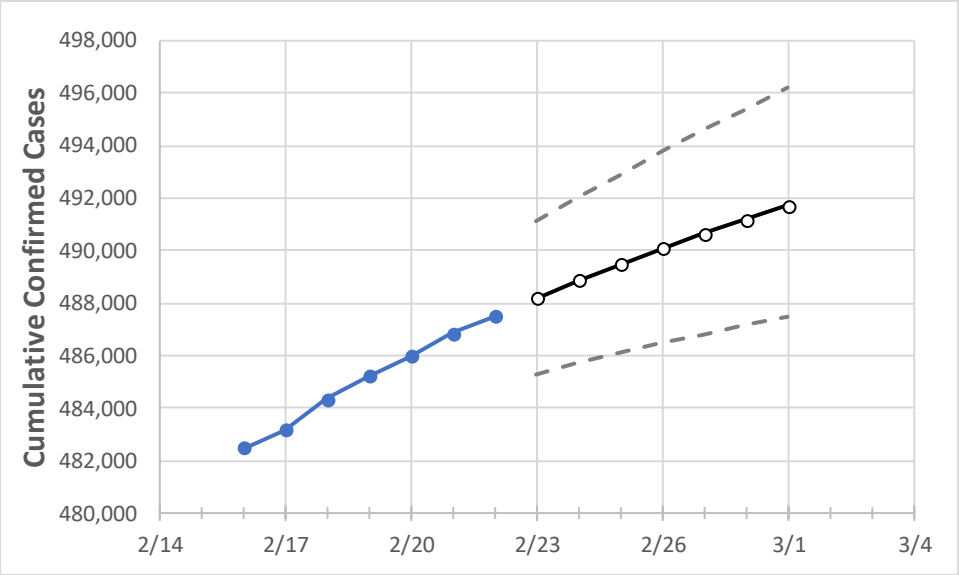
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Alabama	485,212	485,986	486,843	487,520	488,208	488,879	489,489	490,082	490,671	491,206	491,721

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Jefferson	69,995	70,078	70,177	70,249	70,322	70,392	70,455	70,517	70,577	70,631	70,682
Lee	14,766	14,779	14,798	14,809	14,830	14,848	14,866	14,883	14,899	14,913	14,928
Madison	31,823	31,869	31,957	32,008	32,066	32,121	32,174	32,224	32,271	32,317	32,360
Marshall	11,147	11,165	11,174	11,179	11,187	11,195	11,203	11,209	11,216	11,222	11,228
Mobile	35,230	35,289	35,345	35,378	35,433	35,484	35,533	35,580	35,623	35,665	35,705
Montgomery	22,214	22,234	22,294	22,319	22,358	22,394	22,431	22,463	22,495	22,526	22,554
Shelby	21,509	21,565	21,604	21,656	21,695	21,732	21,768	21,802	21,836	21,867	21,898
Tuscaloosa	23,657	23,737	23,783	23,860	23,903	23,946	23,987	24,025	24,066	24,106	24,145

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Jefferson	69,995	70,078	70,177	70,249	70,392 (14,078) [3,379] {1,689}	70,517 (14,103) [3,385] {1,692}	70,631 (14,126) [3,390] {1,695}
Lee	14,766	14,779	14,798	14,809	14,848 (2,970) [713] {356}	14,883 (2,977) [714] {357}	14,913 (2,983) [716] {358}
Madison	31,823	31,869	31,957	32,008	32,121 (6,424) [1,542] {771}	32,224 (6,445) [1,547] {773}	32,317 (6,463) [1,551] {776}
Marshall	11,147	11,165	11,174	11,179	11,195 (2,239) [537] {269}	11,209 (2,242) [538] {269}	11,222 (2,244) [539] {269}
Mobile	35,230	35,289	35,345	35,378	35,484 (7,097) [1,703] {852}	35,580 (7,116) [1,708] {854}	35,665 (7,133) [1,712] {856}
Montgomery	22,214	22,234	22,294	22,319	22,394 (4,479) [1,075] {537}	22,463 (4,493) [1,078] {539}	22,526 (4,505) [1,081] {541}
Shelby	21,509	21,565	21,604	21,656	21,732 (4,346) [1,043] {522}	21,802 (4,360) [1,047] {523}	21,867 (4,373) [1,050] {525}
Tuscaloosa	23,657	23,737	23,783	23,860	23,946 (4,789) [1,149] {575}	24,025 (4,805) [1,153] {577}	24,106 (4,821) [1,157] {579}

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.