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

Date: 1/28/21

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 1/28/21 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.

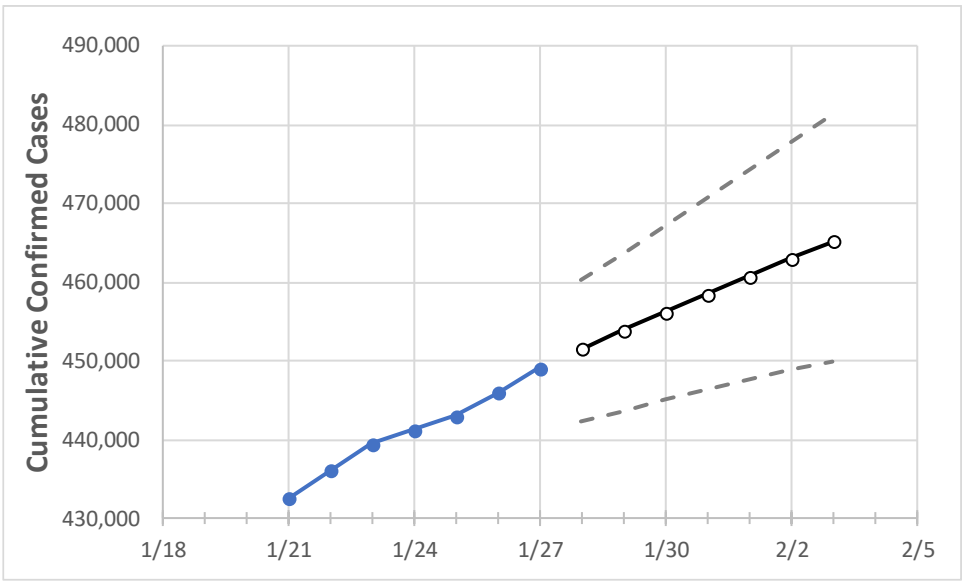
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Alabama	441,170	443,009	445,909	449,086	451,508	453,852	456,224	458,503	460,774	462,985	465,092

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Jefferson	64,681	64,910	65,189	65,606	65,902	66,189	66,465	66,721	66,970	67,213	67,456
Lee	13,205	13,261	13,378	13,482	13,573	13,664	13,750	13,833	13,913	13,996	14,076
Madison	28,310	28,413	28,596	28,795	28,954	29,110	29,259	29,414	29,561	29,701	29,840
Marshall	10,471	10,487	10,513	10,543	10,571	10,599	10,625	10,649	10,673	10,696	10,717
Mobile	31,620	31,746	32,138	32,260	32,446	32,626	32,801	32,979	33,151	33,324	33,498
Montgomery	19,954	20,088	20,220	20,388	20,525	20,665	20,800	20,941	21,072	21,206	21,348
Shelby	19,335	19,452	19,584	19,707	19,807	19,906	20,001	20,094	20,184	20,273	20,365
Tuscaloosa	21,525	21,566	21,703	21,859	21,963	22,060	22,161	22,265	22,369	22,475	22,575

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Jefferson	64,681	64,910	65,189	65,606	66,189 (13,238) [3,177] {1,589}	66,721 (13,344) [3,203] {1,601}	67,213 (13,443) [3,226] {1,613}
Lee	13,205	13,261	13,378	13,482	13,664 (2,733) [656] {328}	13,833 (2,767) [664] {332}	13,996 (2,799) [672] {336}
Madison	28,310	28,413	28,596	28,795	29,110 (5,822) [1,397] {699}	29,414 (5,883) [1,412] {706}	29,701 (5,940) [1,426] {713}
Marshall	10,471	10,487	10,513	10,543	10,599 (2,120) [509] {254}	10,649 (2,130) [511] {256}	10,696 (2,139) [513] {257}
Mobile	31,620	31,746	32,138	32,260	32,626 (6,525) [1,566] {783}	32,979 (6,596) [1,583] {791}	33,324 (6,665) [1,600] {800}
Montgomery	19,954	20,088	20,220	20,388	20,665 (4,133) [992] {496}	20,941 (4,188) [1,005] {503}	21,206 (4,241) [1,018] {509}
Shelby	19,335	19,452	19,584	19,707	19,906 (3,981) [955] {478}	20,094 (4,019) [964] {482}	20,273 (4,055) [973] {487}
Tuscaloosa	21,525	21,566	21,703	21,859	22,060 (4,412) [1,059] {529}	22,265 (4,453) [1,069] {534}	22,475 (4,495) [1,079] {539}

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.