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

Date: 2/3/21

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 2/3/21 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.

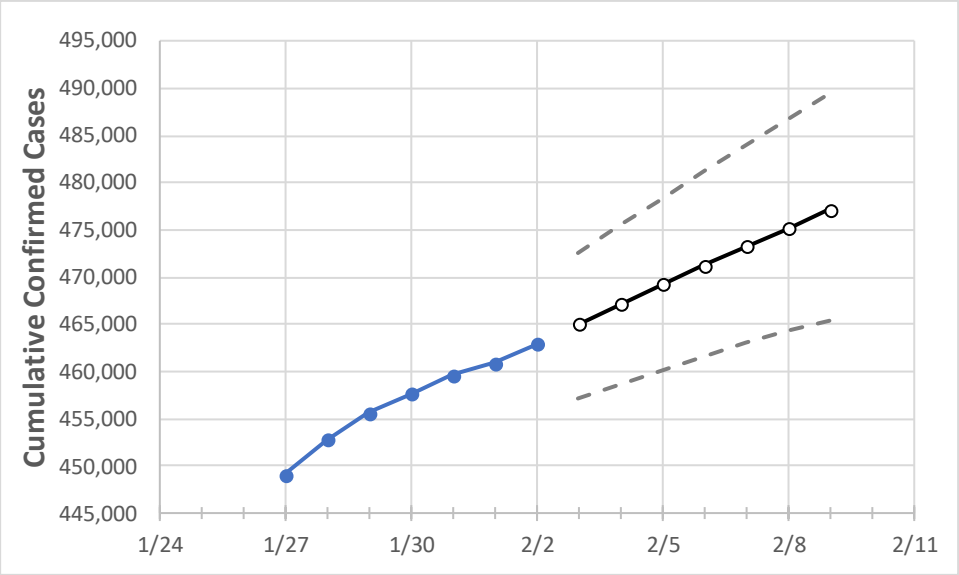
IEM's Modeling Lead

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:						
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9
Alabama	457,611	459,639	460,860	462,938	465,037	467,140	469,205	471,215	473,238	475,174	477,098

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:						
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9
Jefferson	66,604	66,884	67,010	67,359	67,611	67,854	68,091	68,317	68,546	68,761	68,970
Lee	13,754	13,829	13,878	13,958	14,038	14,115	14,190	14,263	14,334	14,406	14,475
Madison	29,507	29,680	29,781	29,906	30,064	30,218	30,366	30,515	30,665	30,810	30,957
Marshall	10,747	10,780	10,789	10,827	10,863	10,898	10,932	10,967	11,001	11,035	11,066
Mobile	32,904	33,060	33,159	33,311	33,481	33,643	33,804	33,959	34,113	34,263	34,408
Montgomery	20,809	20,921	20,966	21,058	21,169	21,280	21,386	21,489	21,591	21,691	21,788
Shelby	20,115	20,216	20,271	20,379	20,479	20,579	20,677	20,770	20,861	20,954	21,046
Tuscaloosa	22,331	22,421	22,519	22,570	22,674	22,781	22,886	22,991	23,094	23,196	23,296

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:		
	1/30	1/31	2/1	2/2	2/4	2/6	2/8
Jefferson	66,604	66,884	67,010	67,359	67,854 (13,571) [3,257] {1,629}	68,317 (13,663) [3,279] {1,640}	68,761 (13,752) [3,301] {1,650}
Lee	13,754	13,829	13,878	13,958	14,115 (2,823) [678] {339}	14,263 (2,853) [685] {342}	14,406 (2,881) [691] {346}
Madison	29,507	29,680	29,781	29,906	30,218 (6,044) [1,450] {725}	30,515 (6,103) [1,465] {732}	30,810 (6,162) [1,479] {739}
Marshall	10,747	10,780	10,789	10,827	10,898 (2,180) [523] {262}	10,967 (2,193) [526] {263}	11,035 (2,207) [530] {265}
Mobile	32,904	33,060	33,159	33,311	33,643 (6,729) [1,615] {807}	33,959 (6,792) [1,630] {815}	34,263 (6,853) [1,645] {822}
Montgomery	20,809	20,921	20,966	21,058	21,280 (4,256) [1,021] {511}	21,489 (4,298) [1,031] {516}	21,691 (4,338) [1,041] {521}
Shelby	20,115	20,216	20,271	20,379	20,579 (4,116) [988] {494}	20,770 (4,154) [997] {498}	20,954 (4,191) [1,006] {503}
Tuscaloosa	22,331	22,421	22,519	22,570	22,781 (4,556) [1,093] {547}	22,991 (4,598) [1,104] {552}	23,196 (4,639) [1,113] {557}

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.