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

Date: 2/10/21

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 2/10/21 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.

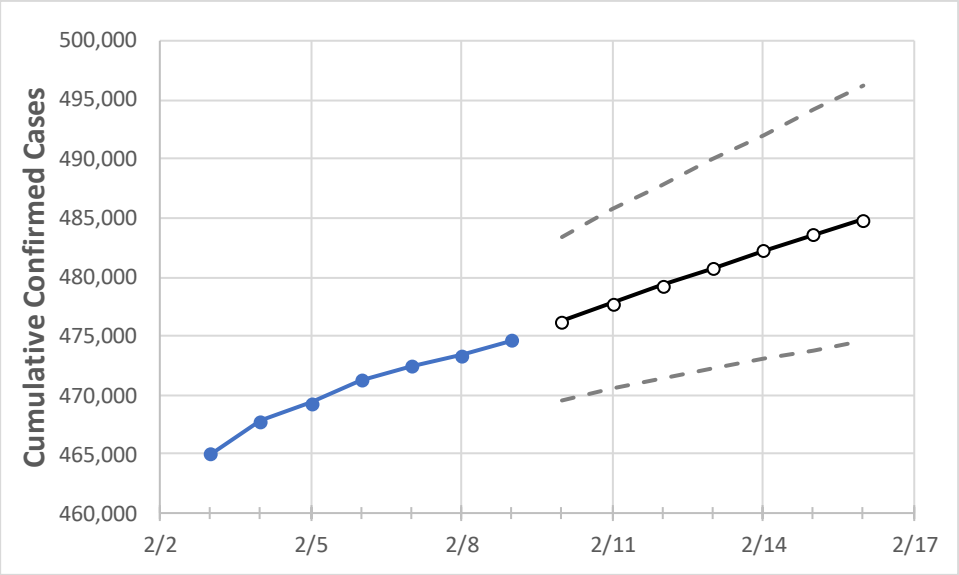
IEM's Modeling Lead

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Alabama	471,311	472,423	473,348	474,666	476,250	477,813	479,280	480,772	482,243	483,589	484,907

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Jefferson	68,322	68,456	68,577	68,747	68,923	69,093	69,253	69,408	69,554	69,695	69,833
Lee	14,277	14,337	14,361	14,391	14,446	14,500	14,551	14,599	14,648	14,694	14,740
Madison	30,626	30,744	30,840	30,919	31,045	31,170	31,295	31,417	31,537	31,653	31,767
Marshall	10,959	10,986	10,989	11,014	11,040	11,068	11,093	11,118	11,142	11,165	11,188
Mobile	33,996	34,090	34,219	34,329	34,455	34,575	34,694	34,807	34,918	35,026	35,130
Montgomery	21,417	21,482	21,514	21,634	21,710	21,783	21,853	21,922	21,988	22,050	22,107
Shelby	20,794	20,845	20,907	20,992	21,071	21,148	21,223	21,298	21,366	21,434	21,502
Tuscaloosa	23,006	23,049	23,123	23,127	23,208	23,283	23,359	23,432	23,504	23,577	23,648

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:		
	2/6	2/7	2/8	2/9	2/11	2/13	2/15
Jefferson	68,322	68,456	68,577	68,747	69,093 (13,819) [3,316] {1,658}	69,408 (13,882) [3,332] {1,666}	69,695 (13,939) [3,345] {1,673}
Lee	14,277	14,337	14,361	14,391	14,500 (2,900) [696] {348}	14,599 (2,920) [701] {350}	14,694 (2,939) [705] {353}
Madison	30,626	30,744	30,840	30,919	31,170 (6,234) [1,496] {748}	31,417 (6,283) [1,508] {754}	31,653 (6,331) [1,519] {760}
Marshall	10,959	10,986	10,989	11,014	11,068 (2,214) [531] {266}	11,118 (2,224) [534] {267}	11,165 (2,233) [536] {268}
Mobile	33,996	34,090	34,219	34,329	34,575 (6,915) [1,660] {830}	34,807 (6,961) [1,671] {835}	35,026 (7,005) [1,681] {841}
Montgomery	21,417	21,482	21,514	21,634	21,783 (4,357) [1,046] {523}	21,922 (4,384) [1,052] {526}	22,050 (4,410) [1,058] {529}
Shelby	20,794	20,845	20,907	20,992	21,148 (4,230) [1,015] {508}	21,298 (4,260) [1,022] {511}	21,434 (4,287) [1,029] {514}
Tuscaloosa	23,006	23,049	23,123	23,127	23,283 (4,657) [1,118] {559}	23,432 (4,686) [1,125] {562}	23,577 (4,715) [1,132] {566}

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.