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

Date: 7/9/21

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 7/9/21 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.

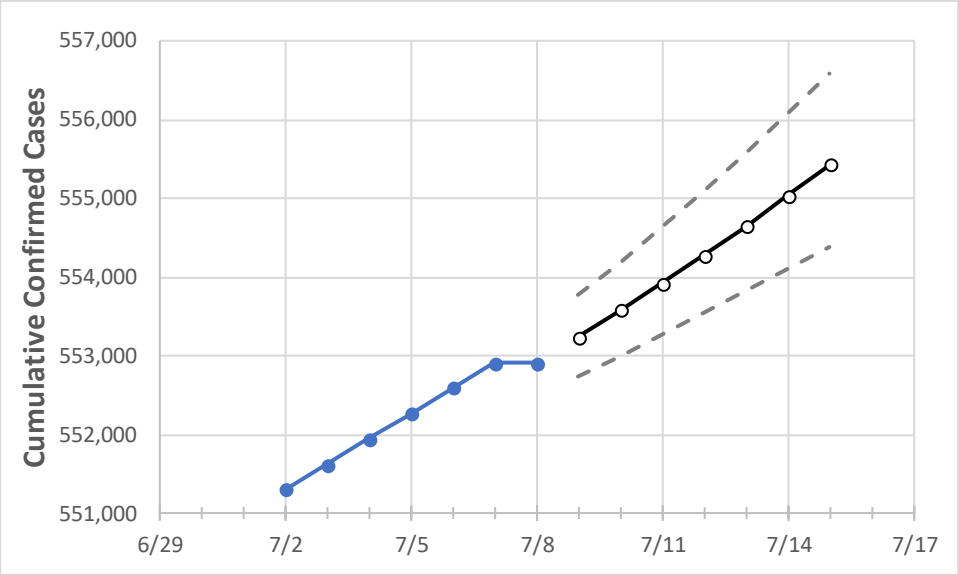
IEM's Modeling Lead

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Alabama	552,266	552,588	552,911	552,911	553,238	553,574	553,920	554,280	554,644	555,032	555,426

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Jefferson	81,435	81,471	81,507	81,507	81,544	81,580	81,616	81,655	81,694	81,733	81,774
Lee	16,371	16,381	16,390	16,390	16,398	16,407	16,416	16,425	16,435	16,445	16,455
Madison	35,912	35,927	35,941	35,941	35,955	35,968	35,981	35,995	36,008	36,021	36,035
Marshall	12,516	12,522	12,527	12,527	12,533	12,538	12,544	12,550	12,556	12,563	12,569
Mobile	42,606	42,666	42,727	42,727	42,787	42,851	42,918	42,987	43,059	43,137	43,218
Montgomery	25,161	25,171	25,182	25,182	25,192	25,203	25,214	25,226	25,238	25,251	25,265
Shelby	25,806	25,827	25,847	25,847	25,869	25,894	25,919	25,945	25,973	26,003	26,035
Tuscaloosa	26,278	26,289	26,301	26,301	26,313	26,325	26,338	26,352	26,366	26,382	26,398

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:		
	7/5	7/6	7/7	7/8	7/10	7/12	7/14
Jefferson	81,435	81,471	81,507	81,507	81,580 (16,316) [3,916] {1,958}	81,655 (16,331) [3,919] {1,960}	81,733 (16,347) [3,923] {1,962}
Lee	16,371	16,381	16,390	16,390	16,407 (3,281) [788] {394}	16,425 (3,285) [788] {394}	16,445 (3,289) [789] {395}
Madison	35,912	35,927	35,941	35,941	35,968 (7,194) [1,726] {863}	35,995 (7,199) [1,728] {864}	36,021 (7,204) [1,729] {865}
Marshall	12,516	12,522	12,527	12,527	12,538 (2,508) [602] {301}	12,550 (2,510) [602] {301}	12,563 (2,513) [603] {302}
Mobile	42,606	42,666	42,727	42,727	42,851 (8,570) [2,057] {1,028}	42,987 (8,597) [2,063] {1,032}	43,137 (8,627) [2,071] {1,035}
Montgomery	25,161	25,171	25,182	25,182	25,203 (5,041) [1,210] {605}	25,226 (5,045) [1,211] {605}	25,251 (5,050) [1,212] {606}
Shelby	25,806	25,827	25,847	25,847	25,894 (5,179) [1,243] {621}	25,945 (5,189) [1,245] {623}	26,003 (5,201) [1,248] {624}
Tuscaloosa	26,278	26,289	26,301	26,301	26,325 (5,265) [1,264] {632}	26,352 (5,270) [1,265] {632}	26,382 (5,276) [1,266] {633}

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.