IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/14/21

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 <u>not</u> 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 7/14/21 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
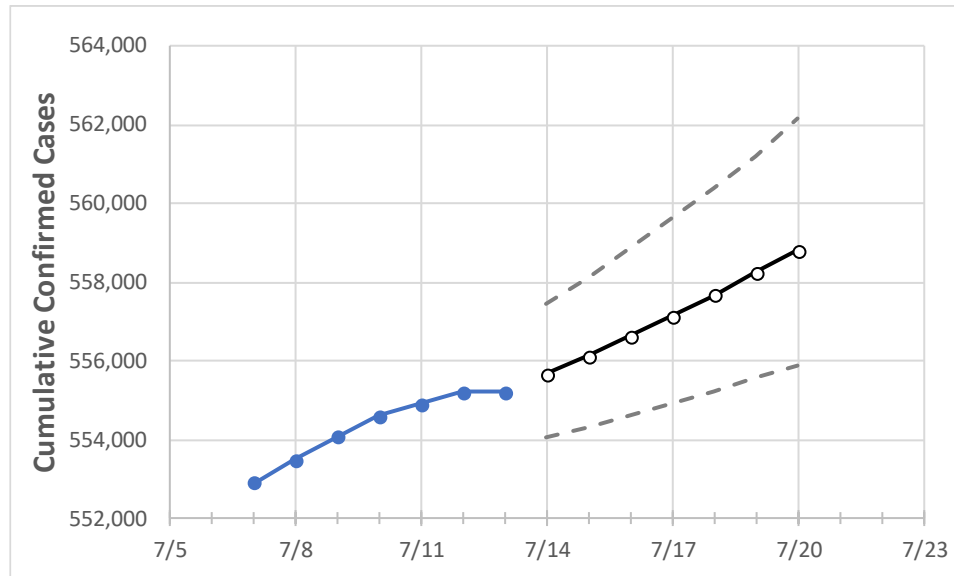
	Actual Confirmed Cases On:				Projected Cases For:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Alabama	554,605	554,910	555,215	555,215	555,660	556,128	556,628	557,143	557,669	558,253	558,815

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Jefferson	81,656	81,693	81,730	81,730	81,774	81,820	81,865	81,913	81,961	82,010	82,062
Lee	16,448	16,451	16,454	16,454	16,466	16,480	16,493	16,507	16,522	16,536	16,552
Madison	36,017	36,032	36,047	36,047	36,067	36,087	36,108	36,129	36,151	36,174	36,197
Marshall	12,564	12,566	12,568	12,568	12,576	12,585	12,594	12,603	12,613	12,623	12,634
Mobile	43,015	43,065	43,114	43,114	43,198	43,286	43,376	43,475	43,580	43,688	43,799
Montgomery	25,250	25,258	25,266	25,266	25,282	25,299	25,317	25,337	25,357	25,381	25,404
Shelby	25,923	25,941	25,959	25,959	25,985	26,013	26,042	26,072	26,103	26,137	26,172
Tuscaloosa	26,332	26,339	26,346	26,346	26,357	26,369	26,381	26,393	26,406	26,419	26,432

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:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Jefferson	81,656	81,693	81,730	81,730	81,820 (16,364) [3,927] {1,964}	81,913 (16,383) [3,932] {1,966}	82,010 (16,402) [3,936] {1,968}
Lee	16,448	16,451	16,454	16,454	16,480 (3,296) [791] {396}	16,507 (3,301) [792] {396}	16,536 (3,307) [794] {397}
Madison	36,017	36,032	36,047	36,047	36,087 (7,217) [1,732] {866}	36,129 (7,226) [1,734] {867}	36,174 (7,235) [1,736] {868}
Marshall	12,564	12,566	12,568	12,568	12,585 (2,517) [604] {302}	12,603 (2,521) [605] {302}	12,623 (2,525) [606] {303}
Mobile	43,015	43,065	43,114	43,114	43,286 (8,657) [2,078] {1,039}	43,475 (8,695) [2,087] {1,043}	43,688 (8,738) [2,097] {1,049}
Montgomery	25,250	25,258	25,266	25,266	25,299 (5,060) [1,214] {607}	25,337 (5,067) [1,216] {608}	25,381 (5,076) [1,218] {609}
Shelby	25,923	25,941	25,959	25,959	26,013 (5,203) [1,249] {624}	26,072 (5,214) [1,251] {626}	26,137 (5,227) [1,255] {627}
Tuscaloosa	26,332	26,339	26,346	26,346	26,369 (5,274) [1,266] {633}	26,393 (5,279) [1,267] {633}	26,419 (5,284) [1,268] {634}

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.