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

Date: 4/21/21

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 4/21/21 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.

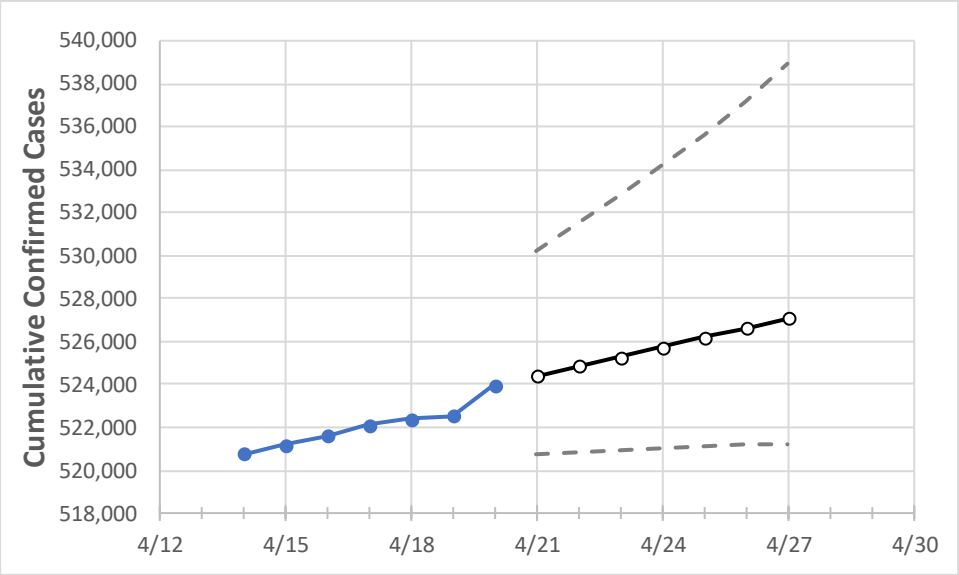
IEM's Modeling Lead

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Alabama	522,131	522,401	522,512	523,955	524,383	524,839	525,284	525,756	526,189	526,637	527,086

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Jefferson	75,483	75,517	75,537	75,582	75,617	75,651	75,684	75,718	75,748	75,779	75,806
Lee	15,614	15,631	15,638	15,642	15,656	15,670	15,684	15,699	15,714	15,729	15,744
Madison	34,084	34,109	34,124	34,153	34,187	34,221	34,257	34,294	34,330	34,367	34,404
Marshall	12,007	12,009	12,012	12,015	12,021	12,027	12,033	12,039	12,045	12,050	12,056
Mobile	39,111	39,126	39,129	40,234	40,345	40,473	40,616	40,782	40,969	41,185	41,425
Montgomery	24,037	24,058	24,059	24,084	24,098	24,112	24,126	24,141	24,154	24,166	24,179
Shelby	23,210	23,221	23,225	23,241	23,252	23,263	23,273	23,284	23,295	23,305	23,315
Tuscaloosa	25,396	25,405	25,408	25,423	25,438	25,452	25,467	25,481	25,496	25,510	25,524

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:		
	4/17	4/18	4/19	4/20	4/22	4/24	4/26
Jefferson	75,483	75,517	75,537	75,582	75,651 (15,130) [3,631] {1,816}	75,718 (15,144) [3,634] {1,817}	75,779 (15,156) [3,637] {1,819}
Lee	15,614	15,631	15,638	15,642	15,670 (3,134) [752] {376}	15,699 (3,140) [754] {377}	15,729 (3,146) [755] {377}
Madison	34,084	34,109	34,124	34,153	34,221 (6,844) [1,643] {821}	34,294 (6,859) [1,646] {823}	34,367 (6,873) [1,650] {825}
Marshall	12,007	12,009	12,012	12,015	12,027 (2,405) [577] {289}	12,039 (2,408) [578] {289}	12,050 (2,410) [578] {289}
Mobile	39,111	39,126	39,129	40,234	40,473 (8,095) [1,943] {971}	40,782 (8,156) [1,958] {979}	41,185 (8,237) [1,977] {988}
Montgomery	24,037	24,058	24,059	24,084	24,112 (4,822) [1,157] {579}	24,141 (4,828) [1,159] {579}	24,166 (4,833) [1,160] {580}
Shelby	23,210	23,221	23,225	23,241	23,263 (4,653) [1,117] {558}	23,284 (4,657) [1,118] {559}	23,305 (4,661) [1,119] {559}
Tuscaloosa	25,396	25,405	25,408	25,423	25,452 (5,090) [1,222] {611}	25,481 (5,096) [1,223] {612}	25,510 (5,102) [1,224] {612}

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.