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

Date: 3/19/21

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 3/19/21 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.

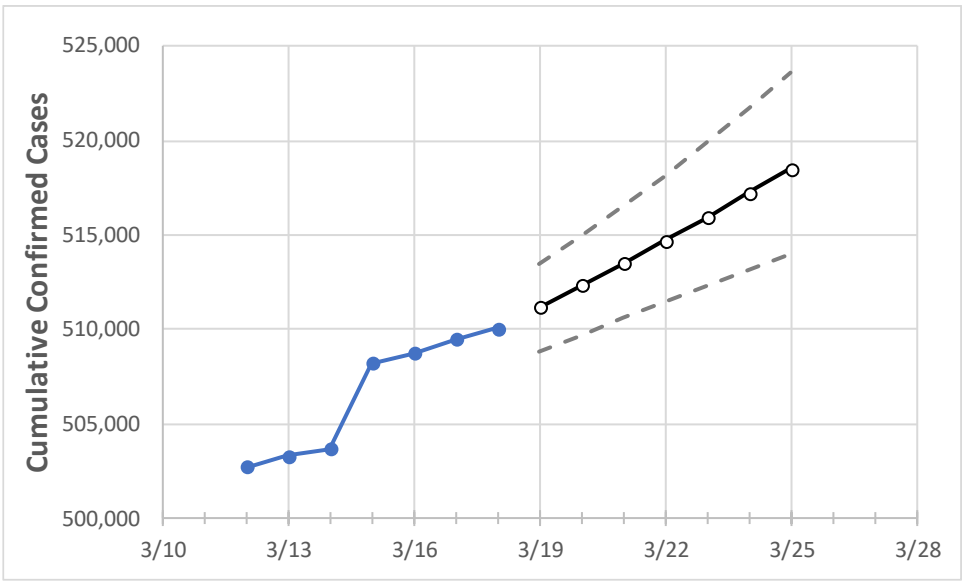
IEM's Modeling Lead

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Alabama	508,229	508,717	509,476	510,048	511,164	512,316	513,475	514,681	515,921	517,211	518,494

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Jefferson	73,525	73,622	73,722	73,832	74,017	74,208	74,415	74,624	74,846	75,080	75,301
Lee	15,197	15,205	15,218	15,231	15,243	15,255	15,267	15,279	15,291	15,302	15,314
Madison	33,013	33,049	33,108	33,174	33,229	33,284	33,343	33,405	33,466	33,530	33,595
Marshall	11,767	11,769	11,780	11,793	11,837	11,884	11,935	11,988	12,044	12,105	12,168
Mobile	36,932	36,979	37,092	37,106	37,163	37,219	37,275	37,331	37,387	37,443	37,499
Montgomery	23,260	23,284	23,317	23,351	23,418	23,490	23,565	23,644	23,728	23,818	23,912
Shelby	22,624	22,666	22,701	22,734	22,774	22,815	22,857	22,896	22,935	22,974	23,015
Tuscaloosa	24,607	24,642	24,677	24,692	24,713	24,732	24,752	24,771	24,789	24,807	24,822

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:		
	3/15	3/16	3/17	3/18	3/20	3/22	3/24
Jefferson	73,525	73,622	73,722	73,832	74,208 (14,842) [3,562] {1,781}	74,624 (14,925) [3,582] {1,791}	75,080 (15,016) [3,604] {1,802}
Lee	15,197	15,205	15,218	15,231	15,255 (3,051) [732] {366}	15,279 (3,056) [733] {367}	15,302 (3,060) [735] {367}
Madison	33,013	33,049	33,108	33,174	33,284 (6,657) [1,598] {799}	33,405 (6,681) [1,603] {802}	33,530 (6,706) [1,609] {805}
Marshall	11,767	11,769	11,780	11,793	11,884 (2,377) [570] {285}	11,988 (2,398) [575] {288}	12,105 (2,421) [581] {291}
Mobile	36,932	36,979	37,092	37,106	37,219 (7,444) [1,787] {893}	37,331 (7,466) [1,792] {896}	37,443 (7,489) [1,797] {899}
Montgomery	23,260	23,284	23,317	23,351	23,490 (4,698) [1,128] {564}	23,644 (4,729) [1,135] {567}	23,818 (4,764) [1,143] {572}
Shelby	22,624	22,666	22,701	22,734	22,815 (4,563) [1,095] {548}	22,896 (4,579) [1,099] {550}	22,974 (4,595) [1,103] {551}
Tuscaloosa	24,607	24,642	24,677	24,692	24,732 (4,946) [1,187] {594}	24,771 (4,954) [1,189] {594}	24,807 (4,961) [1,191] {595}

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.