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

Date: 3/23/21

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 3/23/21 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.

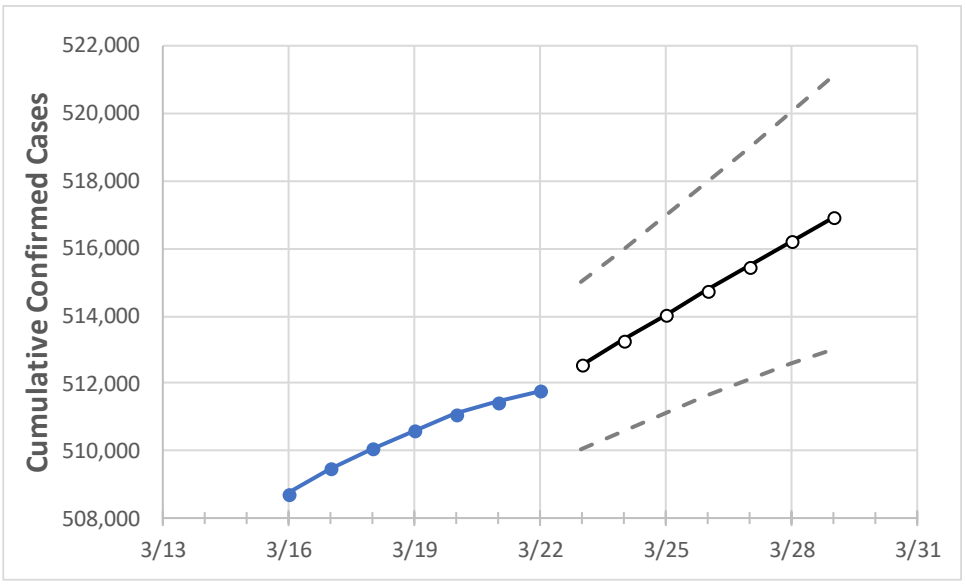
IEM's Modeling Lead

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Alabama	510,579	511,087	511,460	511,779	512,551	513,282	514,018	514,742	515,475	516,191	516,898

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Jefferson	73,921	74,013	74,079	74,132	74,275	74,418	74,556	74,694	74,833	74,977	75,119
Lee	15,248	15,274	15,282	15,290	15,303	15,315	15,327	15,339	15,351	15,363	15,375
Madison	33,210	33,249	33,268	33,292	33,329	33,367	33,403	33,439	33,475	33,512	33,548
Marshall	11,797	11,798	11,803	11,805	11,829	11,853	11,876	11,900	11,923	11,947	11,971
Mobile	37,163	37,182	37,240	37,312	37,368	37,422	37,478	37,535	37,593	37,647	37,702
Montgomery	23,387	23,401	23,426	23,439	23,480	23,519	23,559	23,598	23,636	23,674	23,712
Shelby	22,768	22,789	22,814	22,824	22,855	22,885	22,916	22,945	22,973	23,001	23,029
Tuscaloosa	24,732	24,811	24,844	24,867	24,897	24,928	24,958	24,989	25,020	25,049	25,079

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:		
	3/19	3/20	3/21	3/22	3/24	3/26	3/28
Jefferson	73,921	74,013	74,079	74,132	74,418 (14,884) [3,572] {1,786}	74,694 (14,939) [3,585] {1,793}	74,977 (14,995) [3,599] {1,799}
Lee	15,248	15,274	15,282	15,290	15,315 (3,063) [735] {368}	15,339 (3,068) [736] {368}	15,363 (3,073) [737] {369}
Madison	33,210	33,249	33,268	33,292	33,367 (6,673) [1,602] {801}	33,439 (6,688) [1,605] {803}	33,512 (6,702) [1,609] {804}
Marshall	11,797	11,798	11,803	11,805	11,853 (2,371) [569] {284}	11,900 (2,380) [571] {286}	11,947 (2,389) [573] {287}
Mobile	37,163	37,182	37,240	37,312	37,422 (7,484) [1,796] {898}	37,535 (7,507) [1,802] {901}	37,647 (7,529) [1,807] {904}
Montgomery	23,387	23,401	23,426	23,439	23,519 (4,704) [1,129] {564}	23,598 (4,720) [1,133] {566}	23,674 (4,735) [1,136] {568}
Shelby	22,768	22,789	22,814	22,824	22,885 (4,577) [1,099] {549}	22,945 (4,589) [1,101] {551}	23,001 (4,600) [1,104] {552}
Tuscaloosa	24,732	24,811	24,844	24,867	24,928 (4,986) [1,197] {598}	24,989 (4,998) [1,199] {600}	25,049 (5,010) [1,202] {601}

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.