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

Date: 3/24/21

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 3/24/21 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.

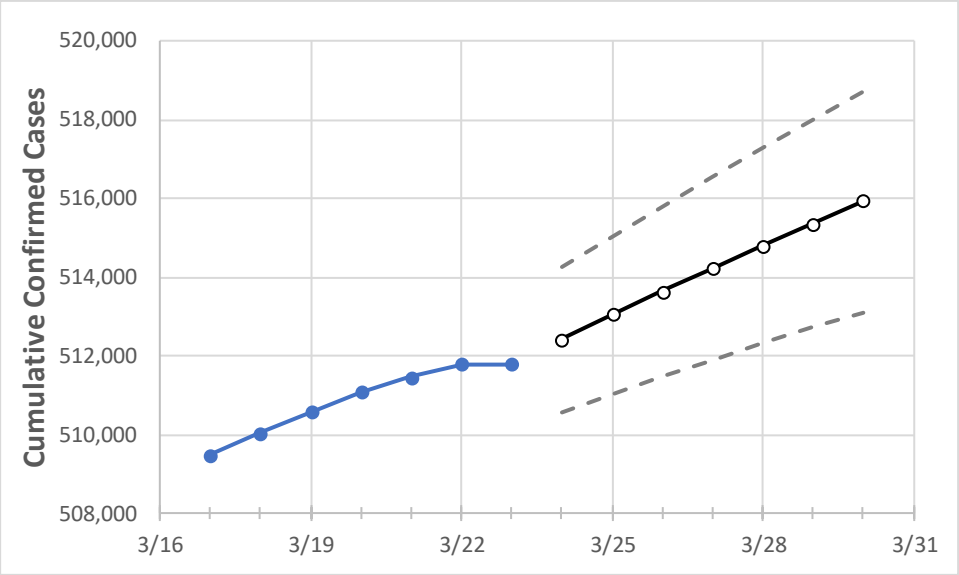
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Alabama	511,087	511,460	511,779	511,789	512,416	513,051	513,636	514,227	514,810	515,369	515,929

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Jefferson	74,013	74,079	74,132	74,093	74,228	74,366	74,503	74,634	74,766	74,898	75,028
Lee	15,274	15,282	15,290	15,292	15,304	15,315	15,327	15,339	15,350	15,361	15,373
Madison	33,249	33,268	33,292	33,285	33,323	33,361	33,397	33,435	33,473	33,511	33,548
Marshall	11,798	11,803	11,805	11,806	11,827	11,847	11,867	11,886	11,907	11,927	11,946
Mobile	37,182	37,240	37,312	37,320	37,371	37,421	37,471	37,520	37,569	37,619	37,667
Montgomery	23,401	23,426	23,439	23,451	23,488	23,522	23,558	23,592	23,626	23,658	23,691
Shelby	22,789	22,814	22,824	22,824	22,855	22,885	22,915	22,944	22,971	22,998	23,026
Tuscaloosa	24,811	24,844	24,867	24,871	24,898	24,924	24,949	24,976	25,001	25,028	25,053

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:		
	3/20	3/21	3/22	3/23	3/25	3/27	3/29
Jefferson	74,013	74,079	74,132	74,093	74,366 (14,873) [3,570] {1,785}	74,634 (14,927) [3,582] {1,791}	74,898 (14,980) [3,595] {1,798}
Lee	15,274	15,282	15,290	15,292	15,315 (3,063) [735] {368}	15,339 (3,068) [736] {368}	15,361 (3,072) [737] {369}
Madison	33,249	33,268	33,292	33,285	33,361 (6,672) [1,601] {801}	33,435 (6,687) [1,605] {802}	33,511 (6,702) [1,609] {804}
Marshall	11,798	11,803	11,805	11,806	11,847 (2,369) [569] {284}	11,886 (2,377) [571] {285}	11,927 (2,385) [572] {286}
Mobile	37,182	37,240	37,312	37,320	37,421 (7,484) [1,796] {898}	37,520 (7,504) [1,801] {900}	37,619 (7,524) [1,806] {903}
Montgomery	23,401	23,426	23,439	23,451	23,522 (4,704) [1,129] {565}	23,592 (4,718) [1,132] {566}	23,658 (4,732) [1,136] {568}
Shelby	22,789	22,814	22,824	22,824	22,885 (4,577) [1,098] {549}	22,944 (4,589) [1,101] {551}	22,998 (4,600) [1,104] {552}
Tuscaloosa	24,811	24,844	24,867	24,871	24,924 (4,985) [1,196] {598}	24,976 (4,995) [1,199] {599}	25,028 (5,006) [1,201] {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.