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

Date: 3/29/21

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 3/29/21 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.

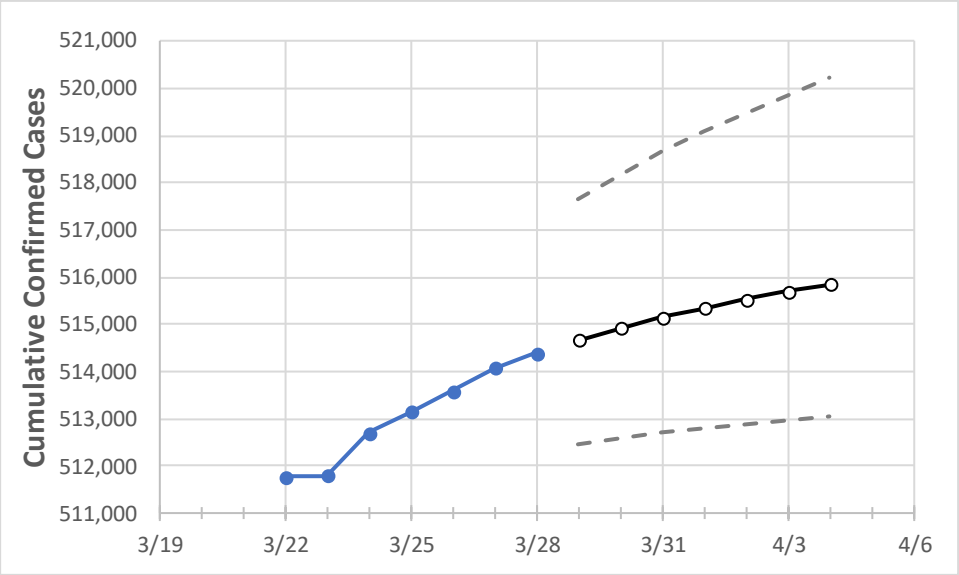
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Alabama	513,138	513,580	514,072	514,391	514,672	514,922	515,146	515,350	515,527	515,692	515,848

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Jefferson	74,348	74,399	74,465	74,521	74,583	74,638	74,690	74,737	74,781	74,823	74,862
Lee	15,355	15,371	15,381	15,389	15,403	15,417	15,430	15,443	15,457	15,471	15,485
Madison	33,362	33,401	33,431	33,463	33,497	33,530	33,560	33,592	33,623	33,653	33,683
Marshall	11,828	11,830	11,839	11,839	11,846	11,853	11,858	11,863	11,866	11,870	11,872
Mobile	37,395	37,420	37,439	37,449	37,480	37,508	37,535	37,561	37,583	37,607	37,628
Montgomery	23,526	23,539	23,630	23,661	23,690	23,717	23,744	23,770	23,796	23,819	23,843
Shelby	22,906	22,930	22,958	22,976	22,993	23,009	23,024	23,038	23,051	23,063	23,075
Tuscaloosa	24,931	24,986	25,000	25,011	25,038	25,063	25,090	25,116	25,141	25,167	25,192

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Jefferson	74,348	74,399	74,465	74,521	74,638 (14,928) [3,583] {1,791}	74,737 (14,947) [3,587] {1,794}	74,823 (14,965) [3,592] {1,796}
Lee	15,355	15,371	15,381	15,389	15,417 (3,083) [740] {370}	15,443 (3,089) [741] {371}	15,471 (3,094) [743] {371}
Madison	33,362	33,401	33,431	33,463	33,530 (6,706) [1,609] {805}	33,592 (6,718) [1,612] {806}	33,653 (6,731) [1,615] {808}
Marshall	11,828	11,830	11,839	11,839	11,853 (2,371) [569] {284}	11,863 (2,373) [569] {285}	11,870 (2,374) [570] {285}
Mobile	37,395	37,420	37,439	37,449	37,508 (7,502) [1,800] {900}	37,561 (7,512) [1,803] {901}	37,607 (7,521) [1,805] {903}
Montgomery	23,526	23,539	23,630	23,661	23,717 (4,743) [1,138] {569}	23,770 (4,754) [1,141] {570}	23,819 (4,764) [1,143] {572}
Shelby	22,906	22,930	22,958	22,976	23,009 (4,602) [1,104] {552}	23,038 (4,608) [1,106] {553}	23,063 (4,613) [1,107] {554}
Tuscaloosa	24,931	24,986	25,000	25,011	25,063 (5,013) [1,203] {602}	25,116 (5,023) [1,206] {603}	25,167 (5,033) [1,208] {604}

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.