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

Date: 3/26/21

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 3/26/21 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.

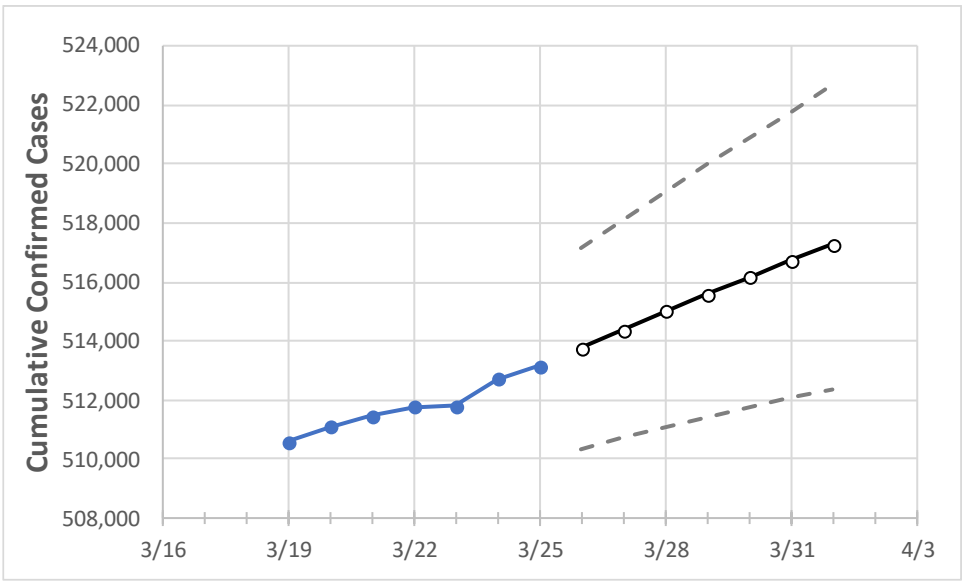
IEM's Modeling Lead

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Alabama	511,779	511,789	512,711	513,138	513,772	514,385	514,997	515,586	516,160	516,725	517,275

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Jefferson	74,132	74,093	74,256	74,348	74,479	74,612	74,744	74,870	75,000	75,134	75,264
Lee	15,290	15,292	15,333	15,355	15,370	15,385	15,400	15,415	15,429	15,444	15,459
Madison	33,292	33,285	33,326	33,362	33,399	33,435	33,470	33,506	33,543	33,578	33,614
Marshall	11,805	11,806	11,816	11,828	11,846	11,864	11,881	11,898	11,913	11,929	11,944
Mobile	37,312	37,320	37,363	37,395	37,442	37,487	37,532	37,576	37,620	37,664	37,706
Montgomery	23,439	23,451	23,504	23,526	23,564	23,601	23,638	23,675	23,711	23,748	23,785
Shelby	22,824	22,855	22,886	22,906	22,934	22,960	22,987	23,013	23,038	23,063	23,086
Tuscaloosa	24,867	24,871	24,928	24,931	24,957	24,981	25,004	25,030	25,055	25,078	25,101

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Jefferson	74,132	74,093	74,256	74,348	74,612 (14,922) [3,581] {1,791}	74,870 (14,974) [3,594] {1,797}	75,134 (15,027) [3,606] {1,803}
Lee	15,290	15,292	15,333	15,355	15,385 (3,077) [738] {369}	15,415 (3,083) [740] {370}	15,444 (3,089) [741] {371}
Madison	33,292	33,285	33,326	33,362	33,435 (6,687) [1,605] {802}	33,506 (6,701) [1,608] {804}	33,578 (6,716) [1,612] {806}
Marshall	11,805	11,806	11,816	11,828	11,864 (2,373) [569] {285}	11,898 (2,380) [571] {286}	11,929 (2,386) [573] {286}
Mobile	37,312	37,320	37,363	37,395	37,487 (7,497) [1,799] {900}	37,576 (7,515) [1,804] {902}	37,664 (7,533) [1,808] {904}
Montgomery	23,439	23,451	23,504	23,526	23,601 (4,720) [1,133] {566}	23,675 (4,735) [1,136] {568}	23,748 (4,750) [1,140] {570}
Shelby	22,824	22,855	22,886	22,906	22,960 (4,592) [1,102] {551}	23,013 (4,603) [1,105] {552}	23,063 (4,613) [1,107] {554}
Tuscaloosa	24,867	24,871	24,928	24,931	24,981 (4,996) [1,199] {600}	25,030 (5,006) [1,201] {601}	25,078 (5,016) [1,204] {602}

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.