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

Date: 4/2/21

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 4/2/21 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.

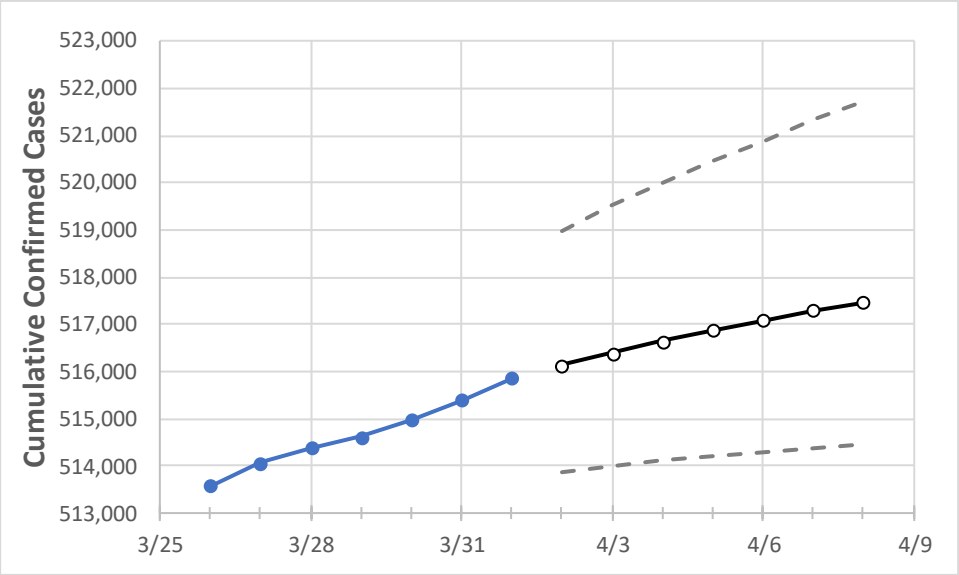
IEM's Modeling Lead

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Alabama	514,619	514,980	515,388	515,866	516,134	516,397	516,633	516,877	517,093	517,295	517,473

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Jefferson	74,571	74,631	74,710	74,789	74,842	74,893	74,940	74,985	75,030	75,072	75,110
Lee	15,394	15,397	15,417	15,433	15,446	15,460	15,473	15,485	15,498	15,511	15,524
Madison	33,480	33,508	33,533	33,577	33,605	33,633	33,661	33,688	33,716	33,742	33,769
Marshall	11,842	11,851	11,854	11,865	11,868	11,870	11,872	11,874	11,875	11,877	11,878
Mobile	37,458	37,473	37,492	37,515	37,534	37,551	37,568	37,584	37,598	37,612	37,626
Montgomery	23,687	23,717	23,743	23,779	23,805	23,831	23,858	23,883	23,908	23,932	23,956
Shelby	22,994	23,025	23,048	23,077	23,097	23,117	23,137	23,156	23,174	23,191	23,209
Tuscaloosa	25,015	25,021	25,059	25,082	25,104	25,125	25,146	25,167	25,186	25,206	25,226

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Jefferson	74,571	74,631	74,710	74,789	74,893 (14,979) [3,595] {1,797}	74,985 (14,997) [3,599] {1,800}	75,072 (15,014) [3,603] {1,802}
Lee	15,394	15,397	15,417	15,433	15,460 (3,092) [742] {371}	15,485 (3,097) [743] {372}	15,511 (3,102) [745] {372}
Madison	33,480	33,508	33,533	33,577	33,633 (6,727) [1,614] {807}	33,688 (6,738) [1,617] {809}	33,742 (6,748) [1,620] {810}
Marshall	11,842	11,851	11,854	11,865	11,870 (2,374) [570] {285}	11,874 (2,375) [570] {285}	11,877 (2,375) [570] {285}
Mobile	37,458	37,473	37,492	37,515	37,551 (7,510) [1,802] {901}	37,584 (7,517) [1,804] {902}	37,612 (7,522) [1,805] {903}
Montgomery	23,687	23,717	23,743	23,779	23,831 (4,766) [1,144] {572}	23,883 (4,777) [1,146] {573}	23,932 (4,786) [1,149] {574}
Shelby	22,994	23,025	23,048	23,077	23,117 (4,623) [1,110] {555}	23,156 (4,631) [1,111] {556}	23,191 (4,638) [1,113] {557}
Tuscaloosa	25,015	25,021	25,059	25,082	25,125 (5,025) [1,206] {603}	25,167 (5,033) [1,208] {604}	25,206 (5,041) [1,210] {605}

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.