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

Date: 3/31/21

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 3/31/21 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.

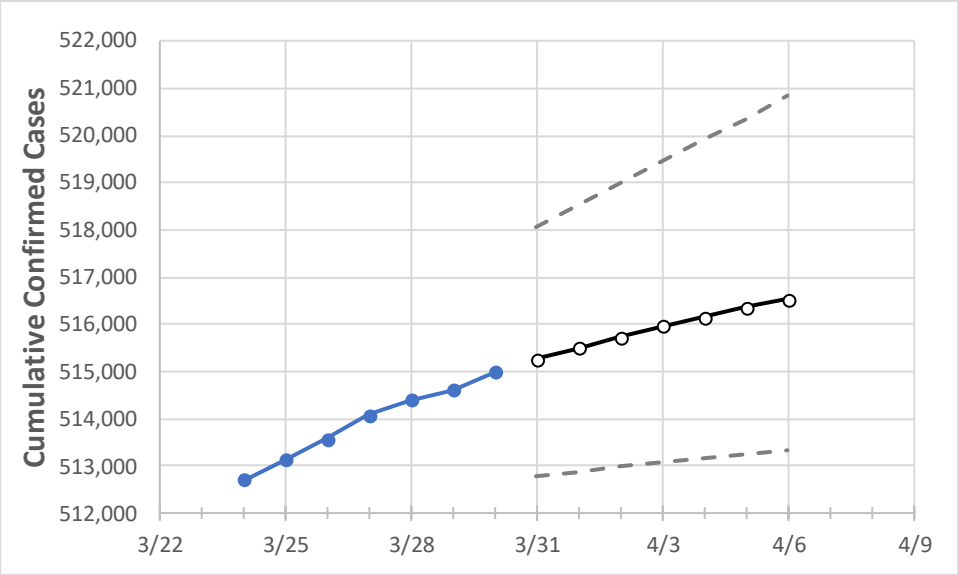
IEM's Modeling Lead

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Alabama	514,072	514,391	514,619	514,980	515,259	515,501	515,736	515,956	516,158	516,358	516,535

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Jefferson	74,465	74,521	74,571	74,631	74,687	74,739	74,787	74,831	74,873	74,916	74,956
Lee	15,381	15,389	15,394	15,397	15,408	15,418	15,430	15,441	15,451	15,462	15,472
Madison	33,431	33,463	33,480	33,508	33,537	33,565	33,592	33,620	33,647	33,674	33,700
Marshall	11,839	11,841	11,842	11,851	11,854	11,857	11,860	11,862	11,864	11,865	11,867
Mobile	37,439	37,449	37,458	37,473	37,496	37,518	37,540	37,561	37,581	37,600	37,619
Montgomery	23,630	23,661	23,687	23,717	23,743	23,769	23,794	23,820	23,844	23,869	23,892
Shelby	22,958	22,976	22,994	23,025	23,044	23,062	23,080	23,097	23,113	23,128	23,144
Tuscaloosa	25,000	25,011	25,015	25,021	25,040	25,059	25,077	25,094	25,111	25,129	25,146

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:		
	3/27	3/28	3/29	3/30	4/1	4/3	4/5
Jefferson	74,465	74,521	74,571	74,631	74,739 (14,948) [3,587] {1,794}	74,831 (14,966) [3,592] {1,796}	74,916 (14,983) [3,596] {1,798}
Lee	15,381	15,389	15,394	15,397	15,418 (3,084) [740] {370}	15,441 (3,088) [741] {371}	15,462 (3,092) [742] {371}
Madison	33,431	33,463	33,480	33,508	33,565 (6,713) [1,611] {806}	33,620 (6,724) [1,614] {807}	33,674 (6,735) [1,616] {808}
Marshall	11,839	11,841	11,842	11,851	11,857 (2,371) [569] {285}	11,862 (2,372) [569] {285}	11,865 (2,373) [570] {285}
Mobile	37,439	37,449	37,458	37,473	37,518 (7,504) [1,801] {900}	37,561 (7,512) [1,803] {901}	37,600 (7,520) [1,805] {902}
Montgomery	23,630	23,661	23,687	23,717	23,769 (4,754) [1,141] {570}	23,820 (4,764) [1,143] {572}	23,869 (4,774) [1,146] {573}
Shelby	22,958	22,976	22,994	23,025	23,062 (4,612) [1,107] {553}	23,097 (4,619) [1,109] {554}	23,128 (4,626) [1,110] {555}
Tuscaloosa	25,000	25,011	25,015	25,021	25,059 (5,012) [1,203] {601}	25,094 (5,019) [1,205] {602}	25,129 (5,026) [1,206] {603}

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.