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

Date: 4/7/21

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 4/7/21 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.

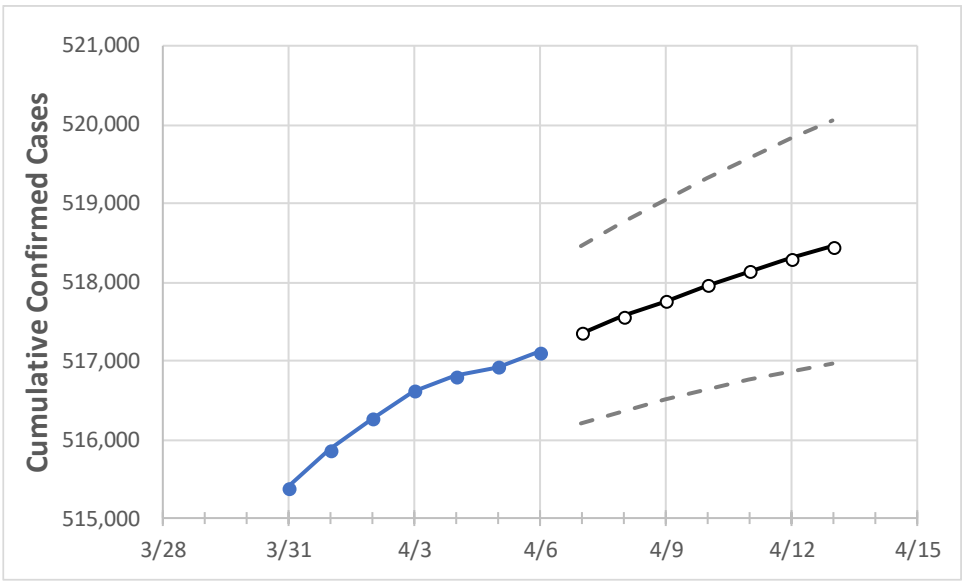
IEM's Modeling Lead

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Alabama	516,615	516,809	516,918	517,114	517,348	517,564	517,761	517,953	518,132	518,297	518,457

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Jefferson	74,917	74,942	74,976	74,987	75,028	75,066	75,102	75,136	75,169	75,200	75,229
Lee	15,452	15,457	15,459	15,468	15,478	15,488	15,497	15,507	15,516	15,525	15,534
Madison	33,646	33,660	33,670	33,692	33,717	33,741	33,765	33,787	33,810	33,833	33,855
Marshall	11,885	11,888	11,890	11,903	11,906	11,908	11,911	11,913	11,914	11,916	11,918
Mobile	37,574	37,590	37,593	37,605	37,619	37,631	37,643	37,656	37,667	37,677	37,687
Montgomery	23,823	23,834	23,836	23,856	23,878	23,900	23,921	23,942	23,961	23,982	24,001
Shelby	23,106	23,116	23,119	23,105	23,119	23,132	23,145	23,157	23,169	23,180	23,191
Tuscaloosa	25,149	25,179	25,187	25,199	25,219	25,239	25,259	25,278	25,297	25,316	25,335

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:		
	4/3	4/4	4/5	4/6	4/8	4/10	4/12
Jefferson	74,917	74,942	74,976	74,987	75,066 (15,013) [3,603] {1,802}	75,136 (15,027) [3,607] {1,803}	75,200 (15,040) [3,610] {1,805}
Lee	15,452	15,457	15,459	15,468	15,488 (3,098) [743] {372}	15,507 (3,101) [744] {372}	15,525 (3,105) [745] {373}
Madison	33,646	33,660	33,670	33,692	33,741 (6,748) [1,620] {810}	33,787 (6,757) [1,622] {811}	33,833 (6,767) [1,624] {812}
Marshall	11,885	11,888	11,890	11,903	11,908 (2,382) [572] {286}	11,913 (2,383) [572] {286}	11,916 (2,383) [572] {286}
Mobile	37,574	37,590	37,593	37,605	37,631 (7,526) [1,806] {903}	37,656 (7,531) [1,807] {904}	37,677 (7,535) [1,809] {904}
Montgomery	23,823	23,834	23,836	23,856	23,900 (4,780) [1,147] {574}	23,942 (4,788) [1,149] {575}	23,982 (4,796) [1,151] {576}
Shelby	23,106	23,116	23,119	23,105	23,132 (4,626) [1,110] {555}	23,157 (4,631) [1,112] {556}	23,180 (4,636) [1,113] {556}
Tuscaloosa	25,149	25,179	25,187	25,199	25,239 (5,048) [1,211] {606}	25,278 (5,056) [1,213] {607}	25,316 (5,063) [1,215] {608}

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.