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

Date: 4/9/21

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 4/9/21 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.

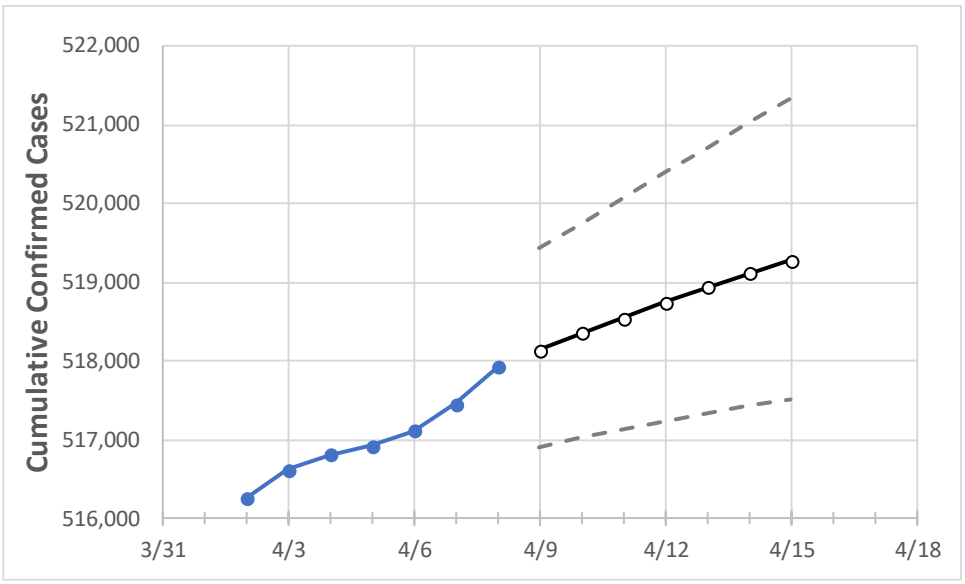
IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Alabama	516,918	517,114	517,452	517,916	518,137	518,346	518,546	518,743	518,932	519,106	519,279

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Jefferson	74,976	74,987	75,095	75,199	75,244	75,289	75,330	75,371	75,410	75,445	75,481
Lee	15,459	15,468	15,474	15,480	15,485	15,491	15,495	15,500	15,505	15,509	15,513
Madison	33,670	33,692	33,710	33,754	33,775	33,796	33,818	33,838	33,856	33,875	33,892
Marshall	11,890	11,903	11,912	11,935	11,939	11,942	11,945	11,948	11,950	11,953	11,955
Mobile	37,593	37,605	37,644	37,661	37,674	37,686	37,698	37,709	37,720	37,730	37,739
Montgomery	23,836	23,856	23,872	23,905	23,923	23,941	23,957	23,973	23,988	24,004	24,018
Shelby	23,119	23,105	23,095	23,085	23,097	23,108	23,119	23,129	23,139	23,148	23,157
Tuscaloosa	25,187	25,199	25,214	25,221	25,235	25,248	25,261	25,273	25,287	25,300	25,311

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:		
	4/5	4/6	4/7	4/8	4/10	4/12	4/14
Jefferson	74,976	74,987	75,095	75,199	75,289 (15,058) [3,614] {1,807}	75,371 (15,074) [3,618] {1,809}	75,445 (15,089) [3,621] {1,811}
Lee	15,459	15,468	15,474	15,480	15,491 (3,098) [744] {372}	15,500 (3,100) [744] {372}	15,509 (3,102) [744] {372}
Madison	33,670	33,692	33,710	33,754	33,796 (6,759) [1,622] {811}	33,838 (6,768) [1,624] {812}	33,875 (6,775) [1,626] {813}
Marshall	11,890	11,903	11,912	11,935	11,942 (2,388) [573] {287}	11,948 (2,390) [573] {287}	11,953 (2,391) [574] {287}
Mobile	37,593	37,605	37,644	37,661	37,686 (7,537) [1,809] {904}	37,709 (7,542) [1,810] {905}	37,730 (7,546) [1,811] {906}
Montgomery	23,836	23,856	23,872	23,905	23,941 (4,788) [1,149] {575}	23,973 (4,795) [1,151] {575}	24,004 (4,801) [1,152] {576}
Shelby	23,119	23,105	23,095	23,085	23,108 (4,622) [1,109] {555}	23,129 (4,626) [1,110] {555}	23,148 (4,630) [1,111] {556}
Tuscaloosa	25,187	25,199	25,214	25,221	25,248 (5,050) [1,212] {606}	25,273 (5,055) [1,213] {607}	25,300 (5,060) [1,214] {607}

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.