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

Date: 4/8/21

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 4/8/21 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.

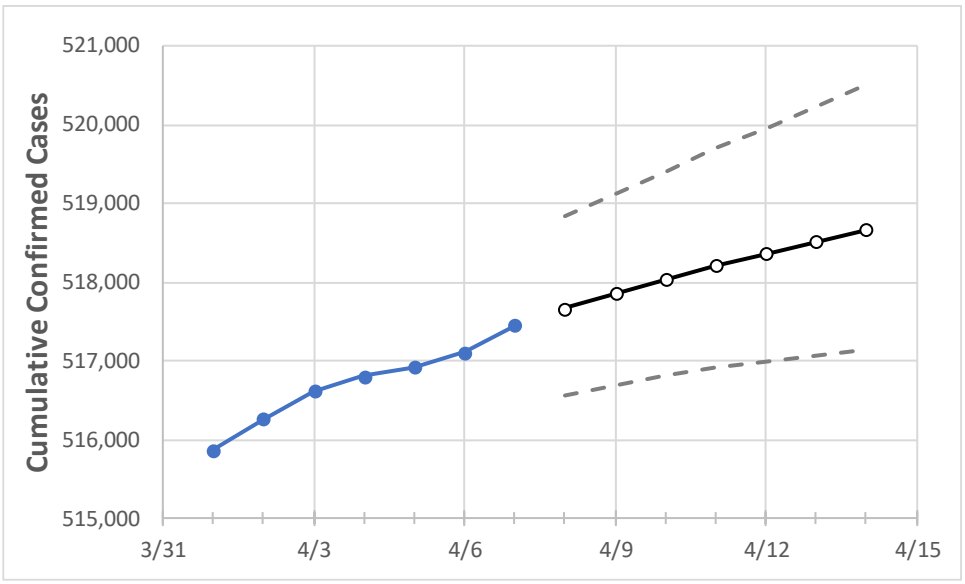
IEM's Modeling Lead

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Alabama	516,809	516,918	517,114	517,452	517,664	517,852	518,037	518,205	518,359	518,516	518,671

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Jefferson	74,942	74,976	74,987	75,095	75,133	75,169	75,204	75,238	75,271	75,300	75,327
Lee	15,457	15,459	15,468	15,468	15,474	15,480	15,485	15,489	15,494	15,498	15,502
Madison	33,660	33,670	33,692	33,710	33,730	33,749	33,768	33,785	33,803	33,821	33,837
Marshall	11,888	11,890	11,903	11,912	11,915	11,918	11,920	11,922	11,924	11,926	11,928
Mobile	37,590	37,593	37,605	37,644	37,658	37,671	37,683	37,696	37,707	37,717	37,728
Montgomery	23,834	23,836	23,856	23,872	23,889	23,906	23,921	23,937	23,951	23,964	23,977
Shelby	23,116	23,119	23,105	23,095	23,108	23,121	23,132	23,143	23,153	23,163	23,173
Tuscaloosa	25,179	25,187	25,199	25,214	25,229	25,246	25,261	25,275	25,291	25,306	25,320

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:		
	4/4	4/5	4/6	4/7	4/9	4/11	4/13
Jefferson	74,942	74,976	74,987	75,095	75,169 (15,034) [3,608] {1,804}	75,238 (15,048) [3,611] {1,806}	75,300 (15,060) [3,614] {1,807}
Lee	15,457	15,459	15,468	15,468	15,480 (3,096) [743] {372}	15,489 (3,098) [743] {372}	15,498 (3,100) [744] {372}
Madison	33,660	33,670	33,692	33,710	33,749 (6,750) [1,620] {810}	33,785 (6,757) [1,622] {811}	33,821 (6,764) [1,623] {812}
Marshall	11,888	11,890	11,903	11,912	11,918 (2,384) [572] {286}	11,922 (2,384) [572] {286}	11,926 (2,385) [572] {286}
Mobile	37,590	37,593	37,605	37,644	37,671 (7,534) [1,808] {904}	37,696 (7,539) [1,809] {905}	37,717 (7,543) [1,810] {905}
Montgomery	23,834	23,836	23,856	23,872	23,906 (4,781) [1,147] {574}	23,937 (4,787) [1,149] {574}	23,964 (4,793) [1,150] {575}
Shelby	23,116	23,119	23,105	23,095	23,121 (4,624) [1,110] {555}	23,143 (4,629) [1,111] {555}	23,163 (4,633) [1,112] {556}
Tuscaloosa	25,179	25,187	25,199	25,214	25,246 (5,049) [1,212] {606}	25,275 (5,055) [1,213] {607}	25,306 (5,061) [1,215] {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.