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

Date: 2/17/21

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 2/17/21 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.

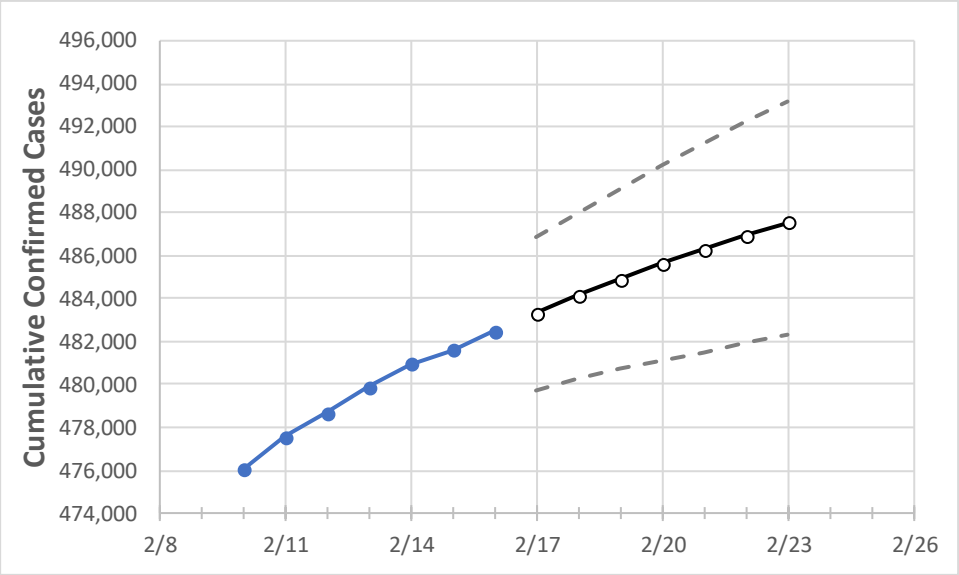
IEM's Modeling Lead

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Alabama	479,856	480,931	481,605	482,488	483,330	484,135	484,896	485,619	486,299	486,934	487,537

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Jefferson	69,364	69,514	69,599	69,747	69,851	69,948	70,037	70,124	70,205	70,280	70,353
Lee	14,563	14,608	14,622	14,641	14,668	14,694	14,718	14,739	14,761	14,780	14,797
Madison	31,432	31,538	31,593	31,649	31,732	31,810	31,887	31,961	32,027	32,093	32,157
Marshall	11,090	11,102	11,105	11,118	11,129	11,139	11,149	11,158	11,167	11,175	11,182
Mobile	34,762	34,840	34,951	35,003	35,086	35,166	35,243	35,314	35,383	35,450	35,512
Montgomery	21,909	21,973	22,008	22,064	22,118	22,168	22,218	22,265	22,310	22,353	22,397
Shelby	21,217	21,277	21,326	21,370	21,412	21,452	21,491	21,529	21,564	21,597	21,628
Tuscaloosa	23,414	23,476	23,505	23,548	23,591	23,631	23,669	23,707	23,737	23,767	23,798

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:		
	2/13	2/14	2/15	2/16	2/18	2/20	2/22
Jefferson	69,364	69,514	69,599	69,747	69,948 (13,990) [3,357] {1,679}	70,124 (14,025) [3,366] {1,683}	70,280 (14,056) [3,373] {1,687}
Lee	14,563	14,608	14,622	14,641	14,694 (2,939) [705] {353}	14,739 (2,948) [707] {354}	14,780 (2,956) [709] {355}
Madison	31,432	31,538	31,593	31,649	31,810 (6,362) [1,527] {763}	31,961 (6,392) [1,534] {767}	32,093 (6,419) [1,540] {770}
Marshall	11,090	11,102	11,105	11,118	11,139 (2,228) [535] {267}	11,158 (2,232) [536] {268}	11,175 (2,235) [536] {268}
Mobile	34,762	34,840	34,951	35,003	35,166 (7,033) [1,688] {844}	35,314 (7,063) [1,695] {848}	35,450 (7,090) [1,702] {851}
Montgomery	21,909	21,973	22,008	22,064	22,168 (4,434) [1,064] {532}	22,265 (4,453) [1,069] {534}	22,353 (4,471) [1,073] {536}
Shelby	21,217	21,277	21,326	21,370	21,452 (4,290) [1,030] {515}	21,529 (4,306) [1,033] {517}	21,597 (4,319) [1,037] {518}
Tuscaloosa	23,414	23,476	23,505	23,548	23,631 (4,726) [1,134] {567}	23,707 (4,741) [1,138] {569}	23,767 (4,753) [1,141] {570}

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.