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

Date: 2/25/21

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 2/25/21 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.

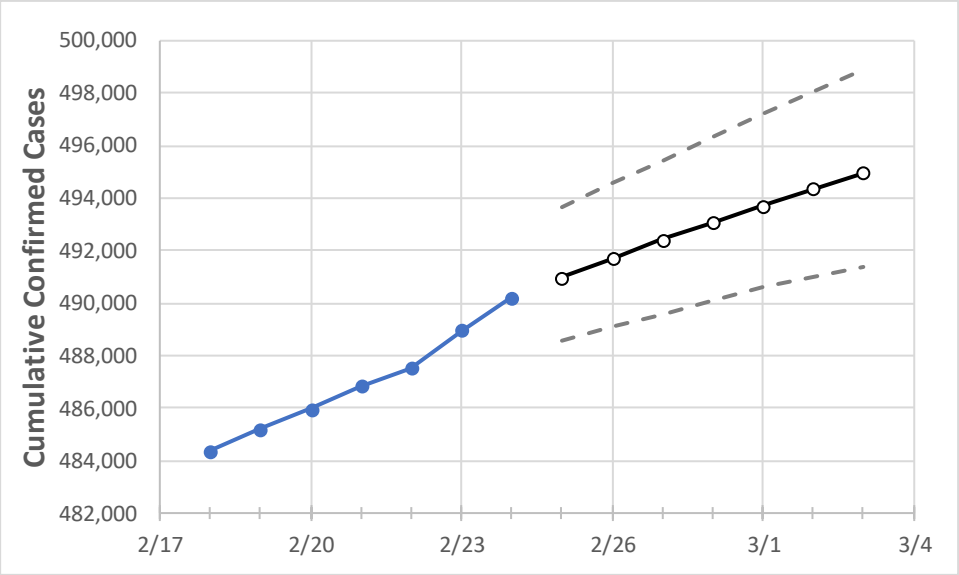
IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Alabama	486,843	487,520	488,973	490,220	490,979	491,720	492,414	493,078	493,733	494,366	494,989

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Jefferson	70,177	70,249	70,332	70,466	70,539	70,610	70,678	70,742	70,803	70,860	70,917
Lee	14,798	14,809	14,827	14,883	14,905	14,926	14,945	14,963	14,979	14,996	15,012
Madison	31,957	32,008	32,088	32,203	32,262	32,319	32,374	32,426	32,478	32,527	32,576
Marshall	11,174	11,179	11,197	11,212	11,221	11,229	11,236	11,244	11,251	11,257	11,264
Mobile	35,345	35,378	35,725	35,810	35,901	35,992	36,083	36,170	36,259	36,346	36,429
Montgomery	22,294	22,319	22,369	22,417	22,454	22,490	22,524	22,556	22,588	22,620	22,649
Shelby	21,604	21,656	21,714	21,773	21,815	21,855	21,894	21,932	21,970	22,006	22,042
Tuscaloosa	23,783	23,860	23,913	23,961	24,005	24,048	24,089	24,130	24,169	24,208	24,245

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:		
	2/21	2/22	2/23	2/24	2/26	2/28	3/2
Jefferson	70,177	70,249	70,332	70,466	70,610 (14,122) [3,389] {1,695}	70,742 (14,148) [3,396] {1,698}	70,860 (14,172) [3,401] {1,701}
Lee	14,798	14,809	14,827	14,883	14,926 (2,985) [716] {358}	14,963 (2,993) [718] {359}	14,996 (2,999) [720] {360}
Madison	31,957	32,008	32,088	32,203	32,319 (6,464) [1,551] {776}	32,426 (6,485) [1,556] {778}	32,527 (6,505) [1,561] {781}
Marshall	11,174	11,179	11,197	11,212	11,229 (2,246) [539] {269}	11,244 (2,249) [540] {270}	11,257 (2,251) [540] {270}
Mobile	35,345	35,378	35,725	35,810	35,992 (7,198) [1,728] {864}	36,170 (7,234) [1,736] {868}	36,346 (7,269) [1,745] {872}
Montgomery	22,294	22,319	22,369	22,417	22,490 (4,498) [1,080] {540}	22,556 (4,511) [1,083] {541}	22,620 (4,524) [1,086] {543}
Shelby	21,604	21,656	21,714	21,773	21,855 (4,371) [1,049] {525}	21,932 (4,386) [1,053] {526}	22,006 (4,401) [1,056] {528}
Tuscaloosa	23,783	23,860	23,913	23,961	24,048 (4,810) [1,154] {577}	24,130 (4,826) [1,158] {579}	24,208 (4,842) [1,162] {581}

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.