IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/23/20

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 12/23/20 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
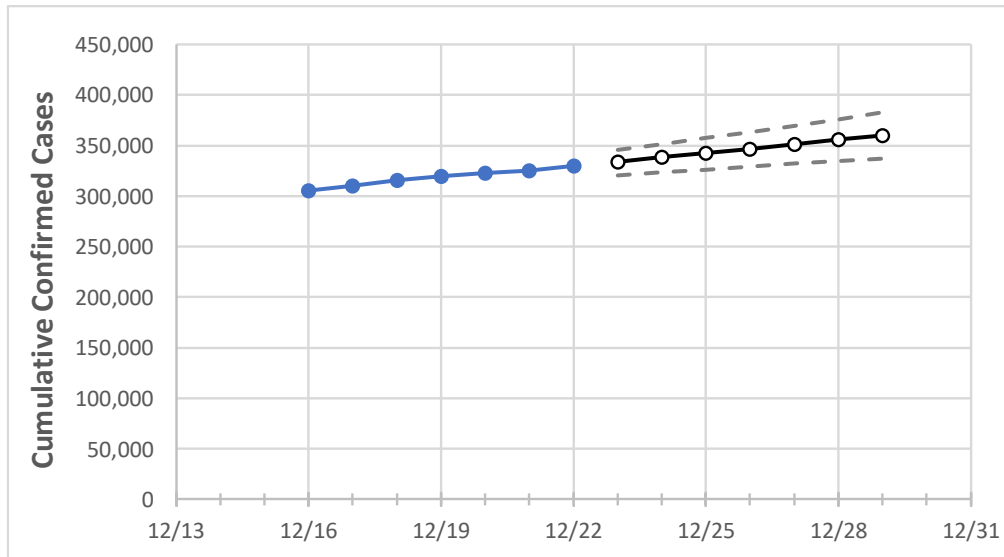
	Actual Confirmed Cases On:				Projected Cases For:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
Alabama	319,904	322,452	324,832	329,811	334,018	338,251	342,561	346,873	351,282	355,747	360,326

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 20%, and are often within 10%, of actual confirmed cases.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
Jefferson	45,092	45,527	46,004	46,794	47,542	48,312	49,080	49,862	50,663	51,484	52,308
Lee	9,283	9,337	9,372	9,490	9,589	9,694	9,799	9,909	10,017	10,129	10,245
Madison	19,062	19,314	19,477	19,899	20,263	20,634	21,001	21,386	21,779	22,180	22,576
Marshall	8,324	8,380	8,389	8,509	8,584	8,657	8,729	8,799	8,869	8,939	9,010
Mobile	23,224	23,463	23,627	23,754	23,943	24,140	24,337	24,537	24,734	24,940	25,144
Montgomery	14,695	14,775	14,858	14,982	15,137	15,291	15,449	15,615	15,785	15,954	16,132
Shelby	13,763	13,888	14,016	14,212	14,387	14,562	14,736	14,915	15,093	15,277	15,459
Tuscaloosa	16,565	16,663	16,770	17,063	17,261	17,461	17,669	17,878	18,089	18,298	18,505

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:		
	12/19	12/20	12/21	12/22	12/24	12/26	12/28
Jefferson	45,092	45,527	46,004	46,794	48,312 (9,662) [2,319] {1,159}	49,862 (9,972) [2,393] {1,197}	51,484 (10,297) [2,471] {1,236}
Lee	9,283	9,337	9,372	9,490	9,694 (1,939) [465] {233}	9,909 (1,982) [476] {238}	10,129 (2,026) [486] {243}
Madison	19,062	19,314	19,477	19,899	20,634 (4,127) [990] {495}	21,386 (4,277) [1,027] {513}	22,180 (4,436) [1,065] {532}
Marshall	8,324	8,380	8,389	8,509	8,657 (1,731) [416] {208}	8,799 (1,760) [422] {211}	8,939 (1,788) [429] {215}
Mobile	23,224	23,463	23,627	23,754	24,140 (4,828) [1,159] {579}	24,537 (4,907) [1,178] {589}	24,940 (4,988) [1,197] {599}
Montgomery	14,695	14,775	14,858	14,982	15,291 (3,058) [734] {367}	15,615 (3,123) [750] {375}	15,954 (3,191) [766] {383}
Shelby	13,763	13,888	14,016	14,212	14,562 (2,912) [699] {349}	14,915 (2,983) [716] {358}	15,277 (3,055) [733] {367}
Tuscaloosa	16,565	16,663	16,770	17,063	17,461 (3,492) [838] {419}	17,878 (3,576) [858] {429}	18,298 (3,660) [878] {439}

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.