IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/8/21

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 <u>not</u> 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 2/8/21 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
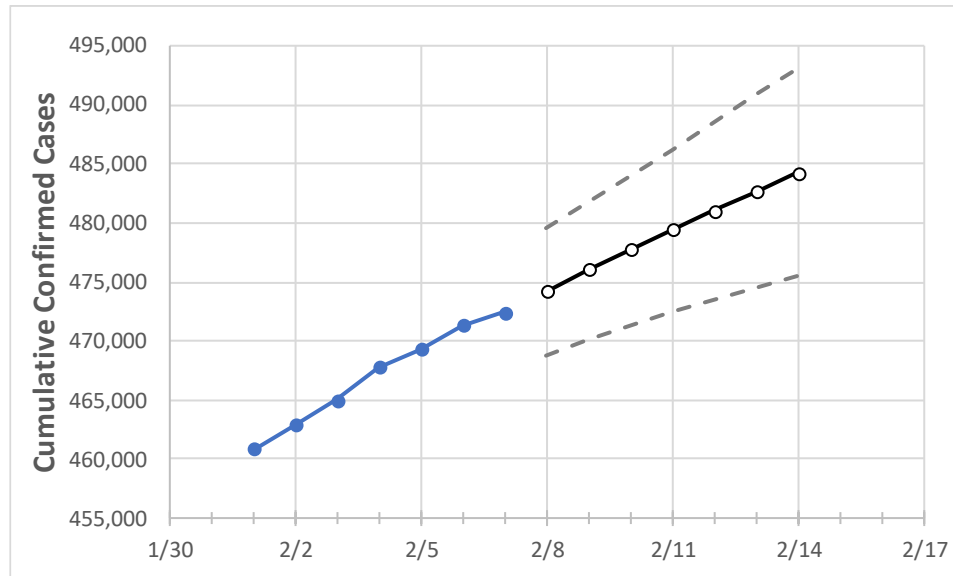
	Actual Confirmed Cases On:				Projected Cases For:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Alabama	467,823	469,319	471,311	472,423	474,243	476,034	477,747	479,424	481,063	482,676	484,228

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Jefferson	67,906	68,090	68,322	68,456	68,666	68,872	69,070	69,261	69,454	69,632	69,805
Lee	14,149	14,197	14,277	14,337	14,404	14,470	14,534	14,598	14,660	14,722	14,784
Madison	30,305	30,473	30,626	30,744	30,905	31,060	31,214	31,361	31,507	31,655	31,796
Marshall	10,905	10,928	10,959	10,986	11,017	11,047	11,077	11,107	11,136	11,167	11,194
Mobile	33,718	33,796	33,996	34,090	34,233	34,368	34,500	34,632	34,764	34,888	35,013
Montgomery	21,233	21,306	21,417	21,482	21,566	21,647	21,727	21,806	21,881	21,955	22,027
Shelby	20,627	20,707	20,794	20,845	20,931	21,016	21,099	21,181	21,258	21,335	21,411
Tuscaloosa	22,876	22,938	23,006	23,049	23,144	23,234	23,318	23,407	23,495	23,581	23,665

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:		
	2/4	2/5	2/6	2/7	2/9	2/11	2/13
Jefferson	67,906	68,090	68,322	68,456	68,872 (13,774) [3,306] {1,653}	69,261 (13,852) [3,325] {1,662}	69,632 (13,926) [3,342] {1,671}
Lee	14,149	14,197	14,277	14,337	14,470 (2,894) [695] {347}	14,598 (2,920) [701] {350}	14,722 (2,944) [707] {353}
Madison	30,305	30,473	30,626	30,744	31,060 (6,212) [1,491] {745}	31,361 (6,272) [1,505] {753}	31,655 (6,331) [1,519] {760}
Marshall	10,905	10,928	10,959	10,986	11,047 (2,209) [530] {265}	11,107 (2,221) [533] {267}	11,167 (2,233) [536] {268}
Mobile	33,718	33,796	33,996	34,090	34,368 (6,874) [1,650] {825}	34,632 (6,926) [1,662] {831}	34,888 (6,978) [1,675] {837}
Montgomery	21,233	21,306	21,417	21,482	21,647 (4,329) [1,039] {520}	21,806 (4,361) [1,047] {523}	21,955 (4,391) [1,054] {527}
Shelby	20,627	20,707	20,794	20,845	21,016 (4,203) [1,009] {504}	21,181 (4,236) [1,017] {508}	21,335 (4,267) [1,024] {512}
Tuscaloosa	22,876	22,938	23,006	23,049	23,234 (4,647) [1,115] {558}	23,407 (4,681) [1,124] {562}	23,581 (4,716) [1,132] {566}

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.