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

Date: 5/18/21

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 5/18/21 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.

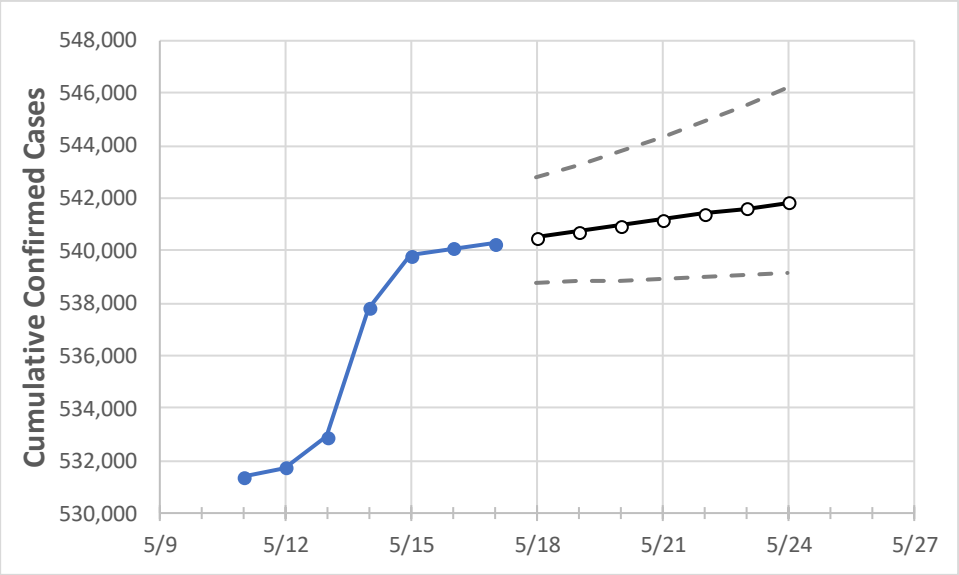
IEM's Modeling Lead

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:						
	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24
Alabama	537,813	539,829	540,083	540,267	540,506	540,747	540,976	541,197	541,412	541,624	541,832

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:						
	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24
Jefferson	79,169	79,827	79,848	79,879	79,906	79,933	79,959	79,984	80,007	80,031	80,056
Lee	15,946	15,987	15,993	15,997	16,004	16,011	16,018	16,025	16,032	16,038	16,045
Madison	35,002	35,132	35,157	35,175	35,196	35,216	35,236	35,256	35,275	35,294	35,313
Marshall	12,262	12,275	12,280	12,280	12,289	12,297	12,305	12,313	12,321	12,330	12,338
Mobile	41,177	41,261	41,283	41,295	41,334	41,374	41,412	41,454	41,496	41,538	41,584
Montgomery	24,549	24,705	24,723	24,736	24,745	24,754	24,762	24,770	24,778	24,786	24,794
Shelby	25,076	25,294	25,302	25,309	25,319	25,328	25,339	25,350	25,359	25,369	25,379
Tuscaloosa	25,871	25,915	25,925	25,932	25,942	25,951	25,960	25,969	25,978	25,986	25,993

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:		
	5/14	5/15	5/16	5/17	5/19	5/21	5/23
Jefferson	79,169	79,827	79,848	79,879	79,933 (15,987) [3,837] {1,918}	79,984 (15,997) [3,839] {1,920}	80,031 (16,006) [3,841] {1,921}
Lee	15,946	15,987	15,993	15,997	16,011 (3,202) [769] {384}	16,025 (3,205) [769] {385}	16,038 (3,208) [770] {385}
Madison	35,002	35,132	35,157	35,175	35,216 (7,043) [1,690] {845}	35,256 (7,051) [1,692] {846}	35,294 (7,059) [1,694] {847}
Marshall	12,262	12,275	12,280	12,280	12,297 (2,459) [590] {295}	12,313 (2,463) [591] {296}	12,330 (2,466) [592] {296}
Mobile	41,177	41,261	41,283	41,295	41,374 (8,275) [1,986] {993}	41,454 (8,291) [1,990] {995}	41,538 (8,308) [1,994] {997}
Montgomery	24,549	24,705	24,723	24,736	24,754 (4,951) [1,188] {594}	24,770 (4,954) [1,189] {594}	24,786 (4,957) [1,190] {595}
Shelby	25,076	25,294	25,302	25,309	25,328 (5,066) [1,216] {608}	25,350 (5,070) [1,217] {608}	25,369 (5,074) [1,218] {609}
Tuscaloosa	25,871	25,915	25,925	25,932	25,951 (5,190) [1,246] {623}	25,969 (5,194) [1,247] {623}	25,986 (5,197) [1,247] {624}

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.