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

Date: 1/19/21

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 1/19/21 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.

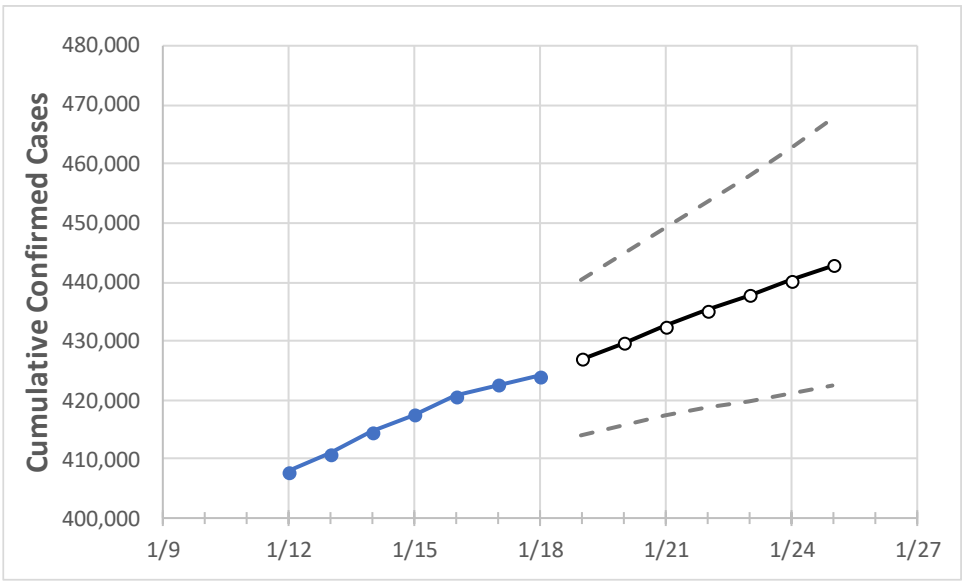
IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Alabama	417,528	420,681	422,598	424,028	426,950	429,673	432,444	435,158	437,716	440,300	442,875

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Jefferson	61,313	61,755	62,039	62,258	62,716	63,166	63,612	64,049	64,473	64,893	65,297
Lee	12,261	12,393	12,465	12,515	12,643	12,774	12,907	13,041	13,173	13,309	13,440
Madison	26,637	26,852	27,052	27,160	27,377	27,592	27,800	28,007	28,214	28,414	28,605
Marshall	10,108	10,158	10,191	10,199	10,246	10,294	10,344	10,390	10,434	10,479	10,522
Mobile	29,768	30,058	30,225	30,381	30,620	30,860	31,098	31,331	31,567	31,799	32,029
Montgomery	18,696	18,876	18,978	19,049	19,179	19,305	19,427	19,545	19,662	19,776	19,891
Shelby	18,310	18,421	18,504	18,572	18,712	18,845	18,977	19,109	19,240	19,366	19,487
Tuscaloosa	20,580	20,652	20,728	20,779	20,856	20,930	21,004	21,074	21,139	21,202	21,264

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:		
	1/15	1/16	1/17	1/18	1/20	1/22	1/24
Jefferson	61,313	61,755	62,039	62,258	63,166 (12,633) [3,032] {1,516}	64,049 (12,810) [3,074] {1,537}	64,893 (12,979) [3,115] {1,557}
Lee	12,261	12,393	12,465	12,515	12,774 (2,555) [613] {307}	13,041 (2,608) [626] {313}	13,309 (2,662) [639] {319}
Madison	26,637	26,852	27,052	27,160	27,592 (5,518) [1,324] {662}	28,007 (5,601) [1,344] {672}	28,414 (5,683) [1,364] {682}
Marshall	10,108	10,158	10,191	10,199	10,294 (2,059) [494] {247}	10,390 (2,078) [499] {249}	10,479 (2,096) [503] {252}
Mobile	29,768	30,058	30,225	30,381	30,860 (6,172) [1,481] {741}	31,331 (6,266) [1,504] {752}	31,799 (6,360) [1,526] {763}
Montgomery	18,696	18,876	18,978	19,049	19,305 (3,861) [927] {463}	19,545 (3,909) [938] {469}	19,776 (3,955) [949] {475}
Shelby	18,310	18,421	18,504	18,572	18,845 (3,769) [905] {452}	19,109 (3,822) [917] {459}	19,366 (3,873) [930] {465}
Tuscaloosa	20,580	20,652	20,728	20,779	20,930 (4,186) [1,005] {502}	21,074 (4,215) [1,012] {506}	21,202 (4,240) [1,018] {509}

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.