IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/3/21

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 12/3/21 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
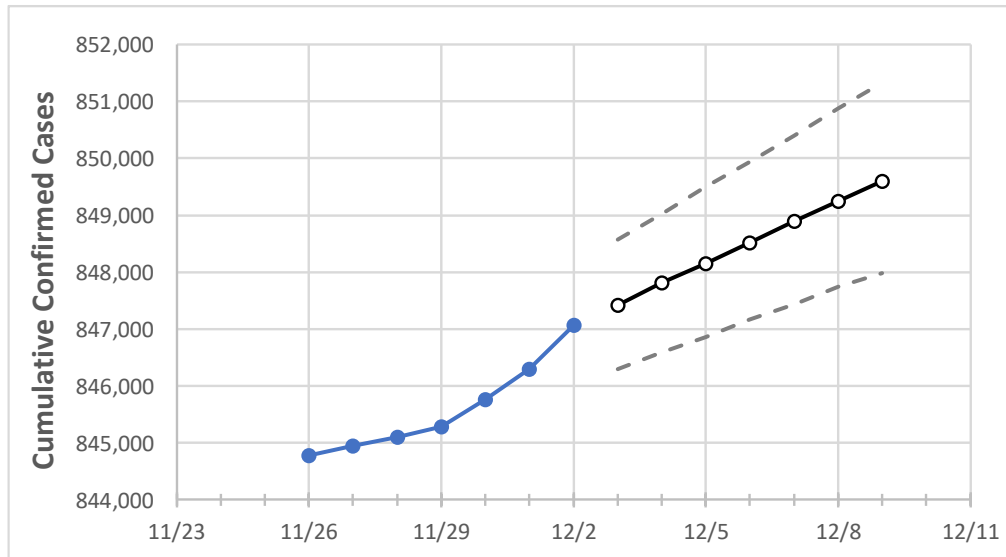
	Actual Confirmed Cases On:				Projected Cases For:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Alabama	845,284	845,761	846,297	847,064	847,424	847,807	848,156	848,518	848,891	849,248	849,594

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Jefferson	116,155	116,186	116,268	116,370	116,406	116,441	116,477	116,513	116,550	116,588	116,627
Lee	25,562	25,590	25,623	25,639	25,652	25,664	25,676	25,689	25,702	25,715	25,728
Madison	53,307	53,315	53,322	53,394	53,417	53,438	53,458	53,479	53,501	53,522	53,542
Marshall	18,782	18,790	18,787	18,812	18,818	18,824	18,829	18,835	18,841	18,847	18,852
Mobile	74,211	74,241	74,271	74,300	74,324	74,347	74,372	74,395	74,416	74,441	74,461
Montgomery	34,492	34,501	34,509	34,535	34,544	34,553	34,563	34,572	34,582	34,591	34,601
Shelby	38,338	38,351	38,372	38,395	38,410	38,423	38,436	38,450	38,463	38,477	38,490
Tuscaloosa	36,022	36,052	36,077	36,096	36,116	36,135	36,154	36,173	36,191	36,212	36,230

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:		
	11/29	11/30	12/1	12/2	12/4	12/6	12/8
Jefferson	116,155	116,186	116,268	116,370	116,441 (23,288) [5,589] {2,795}	116,513 (23,303) [5,593] {2,796}	116,588 (23,318) [5,596] {2,798}
Lee	25,562	25,590	25,623	25,639	25,664 (5,133) [1,232] {616}	25,689 (5,138) [1,233] {617}	25,715 (5,143) [1,234] {617}
Madison	53,307	53,315	53,322	53,394	53,438 (10,688) [2,565] {1,283}	53,479 (10,696) [2,567] {1,283}	53,522 (10,704) [2,569] {1,285}
Marshall	18,782	18,790	18,787	18,812	18,824 (3,765) [904] {452}	18,835 (3,767) [904] {452}	18,847 (3,769) [905] {452}
Mobile	74,211	74,241	74,271	74,300	74,347 (14,869) [3,569] {1,784}	74,395 (14,879) [3,571] {1,785}	74,441 (14,888) [3,573] {1,787}
Montgomery	34,492	34,501	34,509	34,535	34,553 (6,911) [1,659] {829}	34,572 (6,914) [1,659] {830}	34,591 (6,918) [1,660] {830}
Shelby	38,338	38,351	38,372	38,395	38,423 (7,685) [1,844] {922}	38,450 (7,690) [1,846] {923}	38,477 (7,695) [1,847] {923}
Tuscaloosa	36,022	36,052	36,077	36,096	36,135 (7,227) [1,734] {867}	36,173 (7,235) [1,736] {868}	36,212 (7,242) [1,738] {869}

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.