IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/13/21

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 9/13/21 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
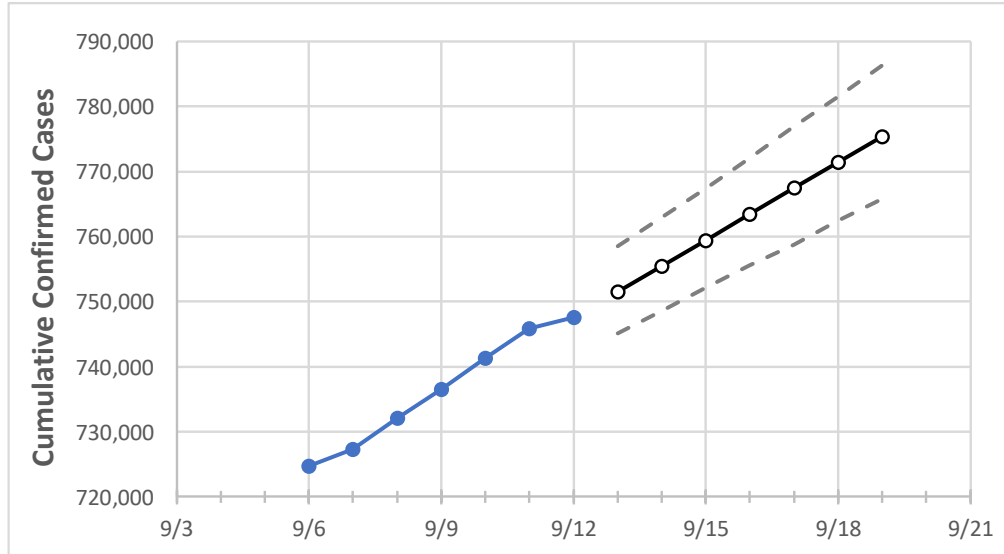
	Actual Confirmed Cases On:				Projected Cases For:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Alabama	736,518	741,318	745,812	747,606	751,582	755,521	759,407	763,455	767,513	771,439	775,400

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Jefferson	105,851	106,362	106,845	107,108	107,607	108,098	108,585	109,072	109,562	110,058	110,537
Lee	21,019	21,132	21,237	21,269	21,357	21,445	21,531	21,620	21,707	21,795	21,882
Madison	46,133	46,513	46,875	47,022	47,291	47,576	47,851	48,128	48,418	48,700	48,979
Marshall	16,531	16,636	16,736	16,764	16,866	16,964	17,066	17,167	17,275	17,378	17,481
Mobile	67,486	68,382	68,791	68,902	69,329	69,724	70,133	70,533	70,937	71,350	71,757
Montgomery	31,559	31,706	31,797	31,908	32,036	32,163	32,289	32,412	32,536	32,660	32,781
Shelby	33,849	34,013	34,222	34,306	34,487	34,667	34,841	35,019	35,197	35,381	35,562
Tuscaloosa	31,649	31,795	31,967	32,045	32,222	32,398	32,577	32,762	32,945	33,137	33,324

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:		
	9/9	9/10	9/11	9/12	9/14	9/16	9/18
Jefferson	105,851	106,362	106,845	107,108	108,098 (21,620) [5,189] {2,594}	109,072 (21,814) [5,235] {2,618}	110,058 (22,012) [5,283] {2,641}
Lee	21,019	21,132	21,237	21,269	21,445 (4,289) [1,029] {515}	21,620 (4,324) [1,038] {519}	21,795 (4,359) [1,046] {523}
Madison	46,133	46,513	46,875	47,022	47,576 (9,515) [2,284] {1,142}	48,128 (9,626) [2,310] {1,155}	48,700 (9,740) [2,338] {1,169}
Marshall	16,531	16,636	16,736	16,764	16,964 (3,393) [814] {407}	17,167 (3,433) [824] {412}	17,378 (3,476) [834] {417}
Mobile	67,486	68,382	68,791	68,902	69,724 (13,945) [3,347] {1,673}	70,533 (14,107) [3,386] {1,693}	71,350 (14,270) [3,425] {1,712}
Montgomery	31,559	31,706	31,797	31,908	32,163 (6,433) [1,544] {772}	32,412 (6,482) [1,556] {778}	32,660 (6,532) [1,568] {784}
Shelby	33,849	34,013	34,222	34,306	34,667 (6,933) [1,664] {832}	35,019 (7,004) [1,681] {840}	35,381 (7,076) [1,698] {849}
Tuscaloosa	31,649	31,795	31,967	32,045	32,398 (6,480) [1,555] {778}	32,762 (6,552) [1,573] {786}	33,137 (6,627) [1,591] {795}

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.