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

Date: 1/12/21

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 1/12/21 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.

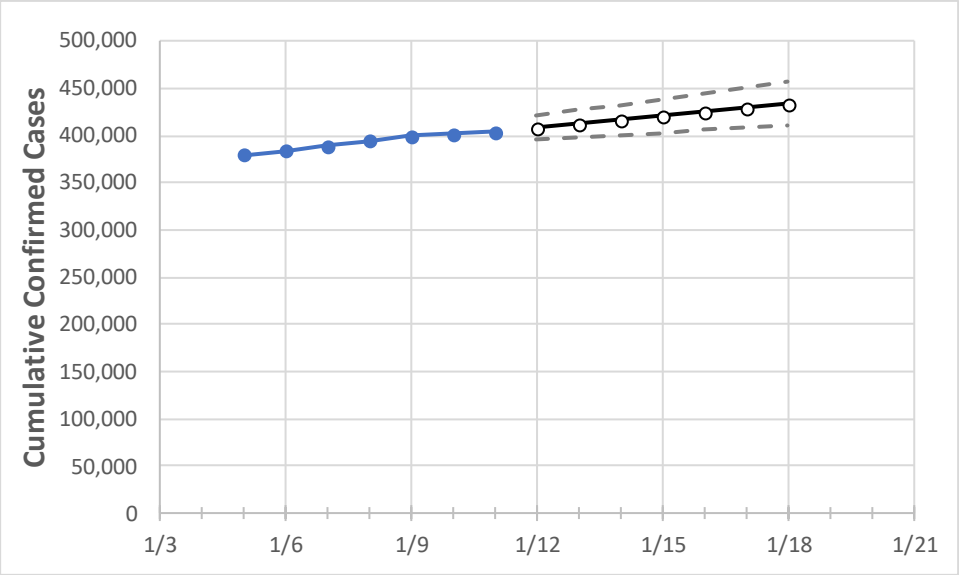
IEM's Modeling Lead

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Alabama	394,287	399,150	401,900	404,000	408,089	412,112	416,149	420,285	424,458	428,678	432,901

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Jefferson	57,609	58,394	58,896	59,248	59,866	60,500	61,136	61,761	62,386	63,008	63,638
Lee	11,355	11,498	11,565	11,626	11,762	11,900	12,043	12,188	12,335	12,490	12,644
Madison	24,795	25,219	25,463	25,643	25,947	26,249	26,549	26,854	27,156	27,460	27,763
Marshall	9,710	9,819	9,854	9,863	9,924	9,985	10,045	10,107	10,168	10,228	10,285
Mobile	28,034	28,266	28,584	28,793	29,079	29,373	29,672	29,976	30,285	30,598	30,913
Montgomery	17,723	17,916	18,064	18,176	18,384	18,592	18,816	19,044	19,277	19,517	19,762
Shelby	17,253	17,449	17,562	17,690	17,872	18,056	18,242	18,428	18,615	18,800	18,989
Tuscaloosa	19,878	20,062	20,142	20,211	20,362	20,513	20,665	20,812	20,960	21,108	21,258

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:		
	1/8	1/9	1/10	1/11	1/13	1/15	1/17
Jefferson	57,609	58,394	58,896	59,248	60,500 (12,100) [2,904] {1,452}	61,761 (12,352) [2,965] {1,482}	63,008 (12,602) [3,024] {1,512}
Lee	11,355	11,498	11,565	11,626	11,900 (2,380) [571] {286}	12,188 (2,438) [585] {293}	12,490 (2,498) [600] {300}
Madison	24,795	25,219	25,463	25,643	26,249 (5,250) [1,260] {630}	26,854 (5,371) [1,289] {644}	27,460 (5,492) [1,318] {659}
Marshall	9,710	9,819	9,854	9,863	9,985 (1,997) [479] {240}	10,107 (2,021) [485] {243}	10,228 (2,046) [491] {245}
Mobile	28,034	28,266	28,584	28,793	29,373 (5,875) [1,410] {705}	29,976 (5,995) [1,439] {719}	30,598 (6,120) [1,469] {734}
Montgomery	17,723	17,916	18,064	18,176	18,592 (3,718) [892] {446}	19,044 (3,809) [914] {457}	19,517 (3,903) [937] {468}
Shelby	17,253	17,449	17,562	17,690	18,056 (3,611) [867] {433}	18,428 (3,686) [885] {442}	18,800 (3,760) [902] {451}
Tuscaloosa	19,878	20,062	20,142	20,211	20,513 (4,103) [985] {492}	20,812 (4,162) [999] {499}	21,108 (4,222) [1,013] {507}

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.