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

Date: 1/8/21

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 1/8/21 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.

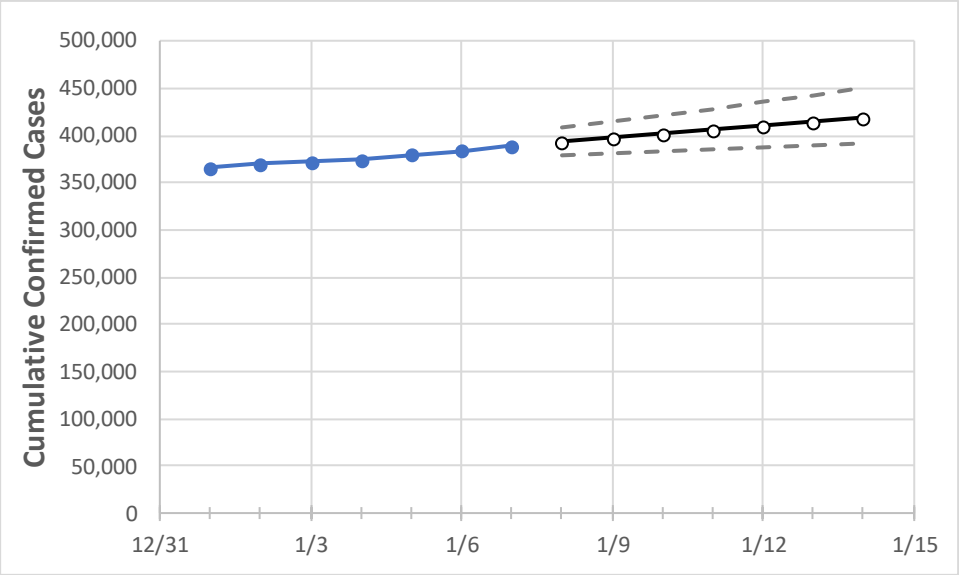
IEM's Modeling Lead

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Alabama	374,095	379,593	384,184	389,230	393,309	397,426	401,592	405,714	410,044	414,530	418,852

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Jefferson	54,349	55,344	56,031	56,823	57,450	58,079	58,694	59,292	59,947	60,590	61,224
Lee	10,656	10,765	10,964	11,179	11,329	11,485	11,648	11,817	11,995	12,180	12,376
Madison	23,563	23,840	24,111	24,395	24,665	24,950	25,230	25,514	25,787	26,065	26,335
Marshall	9,340	9,401	9,497	9,616	9,681	9,746	9,810	9,876	9,941	10,004	10,072
Mobile	26,854	27,099	27,343	27,708	27,992	28,281	28,575	28,875	29,179	29,495	29,815
Montgomery	16,615	17,061	17,281	17,475	17,685	17,909	18,140	18,373	18,614	18,880	19,146
Shelby	16,323	16,622	16,824	17,035	17,222	17,411	17,606	17,802	17,994	18,193	18,398
Tuscaloosa	19,161	19,288	19,485	19,730	19,902	20,081	20,262	20,441	20,627	20,811	21,005

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:		
	1/4	1/5	1/6	1/7	1/9	1/11	1/13
Jefferson	54,349	55,344	56,031	56,823	58,079 (11,616) [2,788] {1,394}	59,292 (11,858) [2,846] {1,423}	60,590 (12,118) [2,908] {1,454}
Lee	10,656	10,765	10,964	11,179	11,485 (2,297) [551] {276}	11,817 (2,363) [567] {284}	12,180 (2,436) [585] {292}
Madison	23,563	23,840	24,111	24,395	24,950 (4,990) [1,198] {599}	25,514 (5,103) [1,225] {612}	26,065 (5,213) [1,251] {626}
Marshall	9,340	9,401	9,497	9,616	9,746 (1,949) [468] {234}	9,876 (1,975) [474] {237}	10,004 (2,001) [480] {240}
Mobile	26,854	27,099	27,343	27,708	28,281 (5,656) [1,357] {679}	28,875 (5,775) [1,386] {693}	29,495 (5,899) [1,416] {708}
Montgomery	16,615	17,061	17,281	17,475	17,909 (3,582) [860] {430}	18,373 (3,675) [882] {441}	18,880 (3,776) [906] {453}
Shelby	16,323	16,622	16,824	17,035	17,411 (3,482) [836] {418}	17,802 (3,560) [854] {427}	18,193 (3,639) [873] {437}
Tuscaloosa	19,161	19,288	19,485	19,730	20,081 (4,016) [964] {482}	20,441 (4,088) [981] {491}	20,811 (4,162) [999] {499}

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.