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

Date: 2/2/21

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 2/2/21 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.

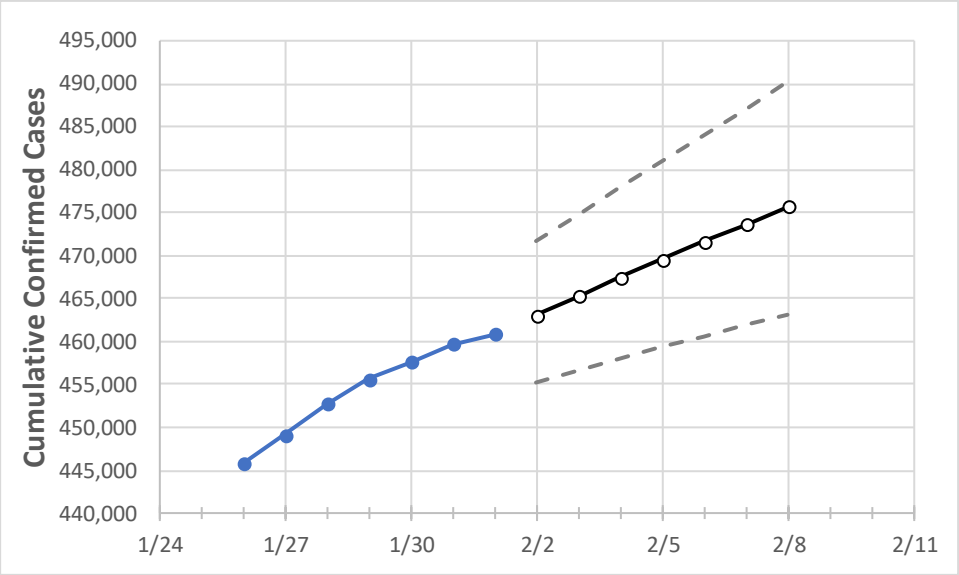
IEM's Modeling Lead

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:						
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8
Alabama	455,582	457,611	459,639	460,860	463,104	465,252	467,427	469,551	471,634	473,643	475,720

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:						
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8
Jefferson	66,323	66,604	66,884	67,010	67,263	67,509	67,747	67,976	68,205	68,431	68,640
Lee	13,679	13,754	13,829	13,878	13,956	14,032	14,109	14,182	14,255	14,324	14,391
Madison	29,333	29,507	29,680	29,781	29,941	30,100	30,252	30,408	30,564	30,713	30,864
Marshall	10,714	10,747	10,780	10,789	10,825	10,861	10,898	10,933	10,967	11,001	11,034
Mobile	32,747	32,904	33,060	33,159	33,325	33,490	33,649	33,804	33,955	34,115	34,269
Montgomery	20,697	20,809	20,921	20,966	21,086	21,202	21,319	21,433	21,542	21,653	21,761
Shelby	20,013	20,115	20,216	20,271	20,375	20,478	20,578	20,678	20,775	20,868	20,963
Tuscaloosa	22,241	22,331	22,421	22,519	22,630	22,742	22,856	22,970	23,086	23,204	23,314

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:		
	1/29	1/30	1/31	2/1	2/3	2/5	2/7
Jefferson	66,323	66,604	66,884	67,010	67,509 (13,502) [3,240] {1,620}	67,976 (13,595) [3,263] {1,631}	68,431 (13,686) [3,285] {1,642}
Lee	13,679	13,754	13,829	13,878	14,032 (2,806) [674] {337}	14,182 (2,836) [681] {340}	14,324 (2,865) [688] {344}
Madison	29,333	29,507	29,680	29,781	30,100 (6,020) [1,445] {722}	30,408 (6,082) [1,460] {730}	30,713 (6,143) [1,474] {737}
Marshall	10,714	10,747	10,780	10,789	10,861 (2,172) [521] {261}	10,933 (2,187) [525] {262}	11,001 (2,200) [528] {264}
Mobile	32,747	32,904	33,060	33,159	33,490 (6,698) [1,608] {804}	33,804 (6,761) [1,623] {811}	34,115 (6,823) [1,638] {819}
Montgomery	20,697	20,809	20,921	20,966	21,202 (4,240) [1,018] {509}	21,433 (4,287) [1,029] {514}	21,653 (4,331) [1,039] {520}
Shelby	20,013	20,115	20,216	20,271	20,478 (4,096) [983] {491}	20,678 (4,136) [993] {496}	20,868 (4,174) [1,002] {501}
Tuscaloosa	22,241	22,331	22,421	22,519	22,742 (4,548) [1,092] {546}	22,970 (4,594) [1,103] {551}	23,204 (4,641) [1,114] {557}

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.