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

Date: 12/1/20

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 12/1/20 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.

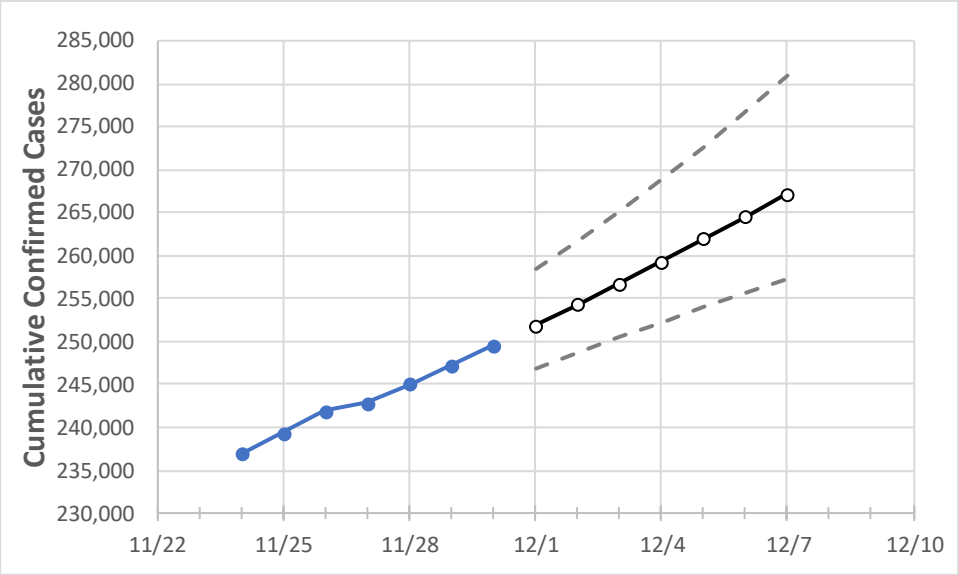
IEM's Modeling Lead

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Alabama	242,874	244,993	247,229	249,524	251,907	254,339	256,821	259,354	261,940	264,578	267,270

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 20%, and are often within 10%, of actual confirmed cases.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Jefferson	31,944	32,314	32,718	33,064	33,456	33,857	34,266	34,684	35,111	35,547	35,992
Lee	7,735	7,757	7,785	7,814	7,853	7,892	7,931	7,971	8,011	8,051	8,092
Madison	13,065	13,223	13,425	13,596	13,798	14,008	14,227	14,456	14,695	14,943	15,203
Marshall	6,213	6,272	6,309	6,353	6,421	6,490	6,561	6,635	6,710	6,786	6,865
Mobile	19,687	19,859	19,904	19,951	20,025	20,099	20,172	20,246	20,319	20,391	20,464
Montgomery	12,286	12,342	12,380	12,435	12,487	12,540	12,592	12,645	12,697	12,749	12,801
Shelby	10,203	10,315	10,465	10,616	10,741	10,870	11,002	11,138	11,277	11,421	11,569
Tuscaloosa	12,983	13,049	13,167	13,246	13,343	13,441	13,541	13,642	13,744	13,847	13,952

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:		
	11/27	11/28	11/29	11/30	12/2	12/4	12/6
Jefferson	31,944	32,314	32,718	33,064	33,857 (6,771) [1,625] {813}	34,684 (6,937) [1,665] {832}	35,547 (7,109) [1,706] {853}
Lee	7,735	7,757	7,785	7,814	7,892 (1,578) [379] {189}	7,971 (1,594) [383] {191}	8,051 (1,610) [386] {193}
Madison	13,065	13,223	13,425	13,596	14,008 (2,802) [672] {336}	14,456 (2,891) [694] {347}	14,943 (2,989) [717] {359}
Marshall	6,213	6,272	6,309	6,353	6,490 (1,298) [312] {156}	6,635 (1,327) [318] {159}	6,786 (1,357) [326] {163}
Mobile	19,687	19,859	19,904	19,951	20,099 (4,020) [965] {482}	20,246 (4,049) [972] {486}	20,391 (4,078) [979] {489}
Montgomery	12,286	12,342	12,380	12,435	12,540 (2,508) [602] {301}	12,645 (2,529) [607] {303}	12,749 (2,550) [612] {306}
Shelby	10,203	10,315	10,465	10,616	10,870 (2,174) [522] {261}	11,138 (2,228) [535] {267}	11,421 (2,284) [548] {274}
Tuscaloosa	12,983	13,049	13,167	13,246	13,441 (2,688) [645] {323}	13,642 (2,728) [655] {327}	13,847 (2,769) [665] {332}

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.