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

Date: 12/22/21

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 12/22/21 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.

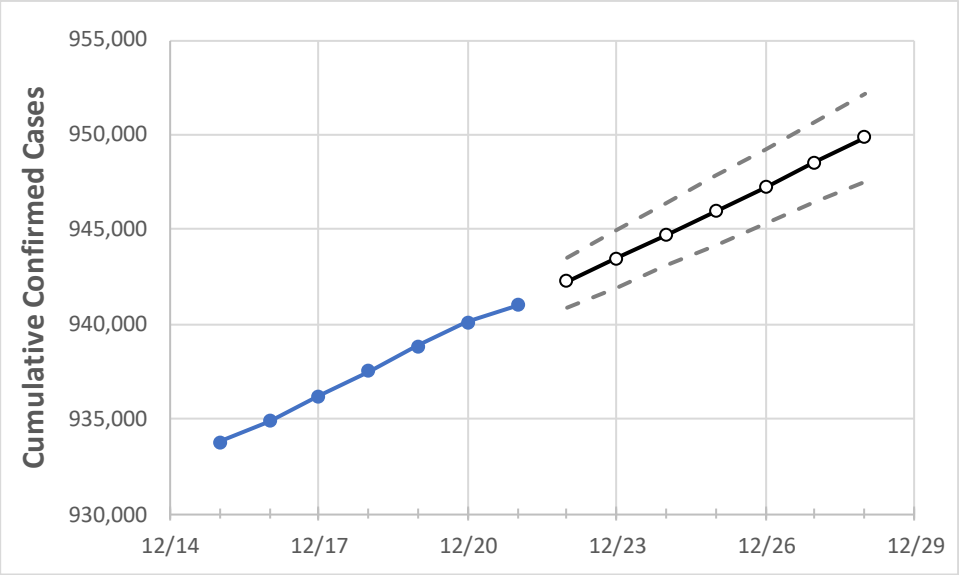
IEM's Modeling Lead

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.

South Carolina State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
South Carolina	937,516	938,826	940,135	941,029	942,253	943,461	944,721	945,969	947,244	948,530	949,851

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.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Beaufort	28,038	28,066	28,094	28,101	28,126	28,153	28,179	28,206	28,233	28,262	28,291
Charleston	67,922	68,024	68,127	68,194	68,278	68,361	68,447	68,534	68,622	68,712	68,799
Greenville	110,030	110,183	110,336	110,456	110,605	110,755	110,906	111,062	111,220	111,378	111,541
Kershaw	12,704	12,725	12,746	12,753	12,778	12,802	12,828	12,852	12,878	12,904	12,930
Lexington	56,650	56,735	56,819	56,892	56,969	57,047	57,125	57,205	57,286	57,370	57,453
Richland	71,364	71,472	71,579	71,662	71,750	71,842	71,934	72,031	72,130	72,231	72,334
Spartanburg	64,269	64,346	64,422	64,469	64,535	64,601	64,668	64,734	64,802	64,871	64,941
York	49,752	49,843	49,934	50,009	50,104	50,201	50,298	50,398	50,498	50,598	50,701

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.*

South Carolina Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:			
	12/18	12/19	12/20	12/21	12/23	12/25	12/27	
Beaufort	28,038	28,066	28,094	28,101	28,153 (5,631) [1,351] {676}	28,206 (5,641) [1,354] {677}	28,262 (5,652) [1,357] {678}	
Charleston	67,922	68,024	68,127	68,194	68,361 (13,672) [3,281] {1,641}	68,534 (13,707) [3,290] {1,645}	68,712 (13,742) [3,298] {1,649}	
Greenville	110,030	110,183	110,336	110,456	110,755 (22,151) [5,316] {2,658}	111,062 (22,212) [5,331] {2,665}	111,378 (22,276) [5,346] {2,673}	
Kershaw	12,704	12,725	12,746	12,753	12,802 (2,560) [615] {307}	12,852 (2,570) [617] {308}	12,904 (2,581) [619] {310}	
Lexington	56,650	56,735	56,819	56,892	57,047 (11,409) [2,738] {1,369}	57,205 (11,441) [2,746] {1,373}	57,370 (11,474) [2,754] {1,377}	
Richland	71,364	71,472	71,579	71,662	71,842 (14,368) [3,448] {1,724}	72,031 (14,406) [3,458] {1,729}	72,231 (14,446) [3,467] {1,734}	
Spartanburg	64,269	64,346	64,422	64,469	64,601 (12,920) [3,101] {1,550}	64,734 (12,947) [3,107] {1,554}	64,871 (12,974) [3,114] {1,557}	
York	49,752	49,843	49,934	50,009	50,201 (10,040) [2,410] {1,205}	50,398 (10,080) [2,419] {1,210}	50,598 (10,120) [2,429] {1,214}	

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.