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

Date: 3/17/21

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 3/17/21 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.

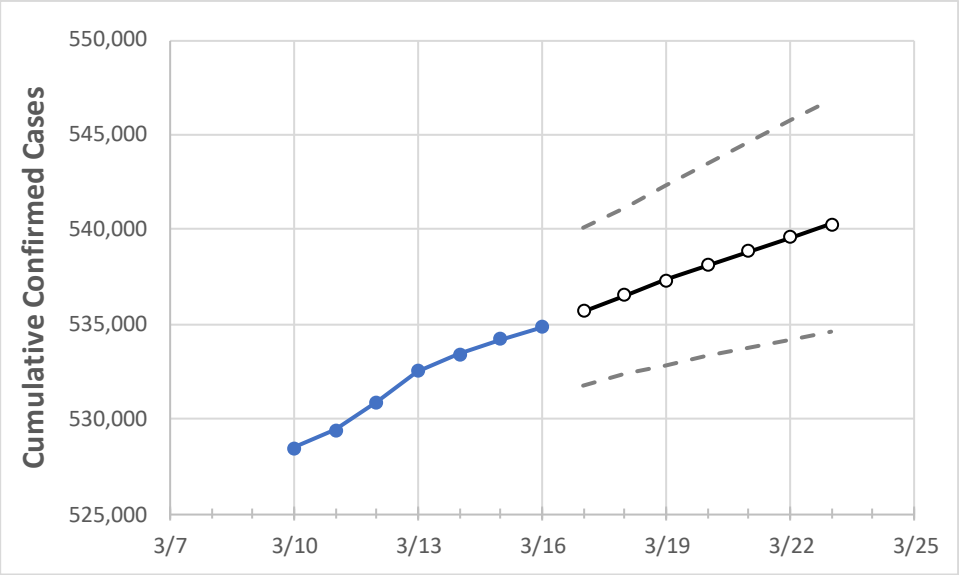
IEM's Modeling Lead

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
South Carolina	532,549	533,421	534,188	534,869	535,701	536,540	537,343	538,109	538,858	539,583	540,280

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Beaufort	15,870	15,891	15,905	15,921	15,944	15,967	15,988	16,009	16,029	16,048	16,065
Charleston	39,165	39,244	39,317	39,379	39,444	39,509	39,572	39,635	39,695	39,755	39,813
Greenville	66,067	66,214	66,331	66,439	66,582	66,721	66,864	66,992	67,126	67,263	67,395
Kershaw	6,853	6,857	6,867	6,885	6,893	6,900	6,906	6,913	6,919	6,924	6,930
Lexington	30,643	30,664	30,717	30,760	30,799	30,835	30,871	30,905	30,938	30,969	30,998
Richland	42,489	42,555	42,625	42,685	42,745	42,804	42,866	42,923	42,975	43,029	43,081
Spartanburg	37,119	37,186	37,222	37,260	37,327	37,391	37,456	37,516	37,576	37,637	37,694
York	27,535	27,559	27,637	27,676	27,724	27,773	27,818	27,862	27,907	27,949	27,991

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:		
	3/13	3/14	3/15	3/16	3/18	3/20	3/22
Beaufort	15,870	15,891	15,905	15,921	15,967 (3,193) [766] {383}	16,009 (3,202) [768] {384}	16,048 (3,210) [770] {385}
Charleston	39,165	39,244	39,317	39,379	39,509 (7,902) [1,896] {948}	39,635 (7,927) [1,902] {951}	39,755 (7,951) [1,908] {954}
Greenville	66,067	66,214	66,331	66,439	66,721 (13,344) [3,203] {1,601}	66,992 (13,398) [3,216] {1,608}	67,263 (13,453) [3,229] {1,614}
Kershaw	6,853	6,857	6,867	6,885	6,900 (1,380) [331] {166}	6,913 (1,383) [332] {166}	6,924 (1,385) [332] {166}
Lexington	30,643	30,664	30,717	30,760	30,835 (6,167) [1,480] {740}	30,905 (6,181) [1,483] {742}	30,969 (6,194) [1,486] {743}
Richland	42,489	42,555	42,625	42,685	42,804 (8,561) [2,055] {1,027}	42,923 (8,585) [2,060] {1,030}	43,029 (8,606) [2,065] {1,033}
Spartanburg	37,119	37,186	37,222	37,260	37,391 (7,478) [1,795] {897}	37,516 (7,503) [1,801] {900}	37,637 (7,527) [1,807] {903}
York	27,535	27,559	27,637	27,676	27,773 (5,555) [1,333] {667}	27,862 (5,572) [1,337] {669}	27,949 (5,590) [1,342] {671}

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.