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

Date: 3/19/21

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 3/19/21 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.

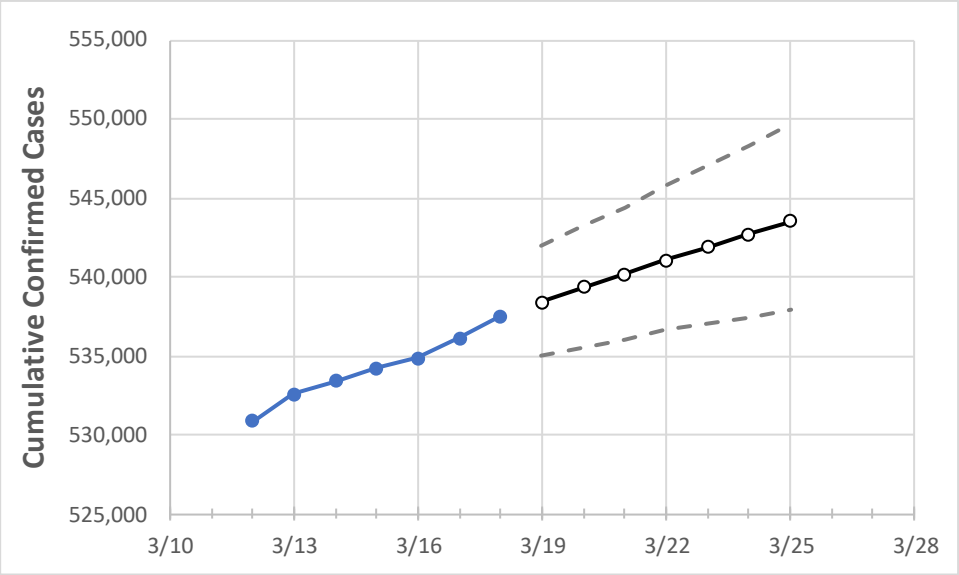
IEM's Modeling Lead

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
South Carolina	534,188	534,869	536,100	537,498	538,416	539,317	540,198	541,070	541,893	542,708	543,509

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:						
	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25
Beaufort	15,905	15,921	15,944	15,977	15,997	16,016	16,034	16,052	16,068	16,084	16,099
Charleston	39,317	39,379	39,463	39,601	39,670	39,739	39,807	39,872	39,938	40,003	40,067
Greenville	66,331	66,439	66,633	66,812	66,950	67,085	67,218	67,348	67,477	67,602	67,722
Kershaw	6,867	6,885	6,904	6,919	6,929	6,939	6,949	6,958	6,967	6,976	6,986
Lexington	30,717	30,760	30,813	30,887	30,927	30,966	31,004	31,041	31,077	31,112	31,145
Richland	42,625	42,685	42,762	42,890	42,960	43,030	43,096	43,162	43,226	43,290	43,350
Spartanburg	37,222	37,260	37,358	37,446	37,516	37,582	37,647	37,706	37,766	37,826	37,879
York	27,637	27,676	27,745	27,838	27,898	27,956	28,014	28,069	28,124	28,176	28,226

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:		
	3/15	3/16	3/17	3/18	3/20	3/22	3/24
Beaufort	15,905	15,921	15,944	15,977	16,016 (3,203) [769] {384}	16,052 (3,210) [770] {385}	16,084 (3,217) [772] {386}
Charleston	39,317	39,379	39,463	39,601	39,739 (7,948) [1,907] {954}	39,872 (7,974) [1,914] {957}	40,003 (8,001) [1,920] {960}
Greenville	66,331	66,439	66,633	66,812	67,085 (13,417) [3,220] {1,610}	67,348 (13,470) [3,233] {1,616}	67,602 (13,520) [3,245] {1,622}
Kershaw	6,867	6,885	6,904	6,919	6,939 (1,388) [333] {167}	6,958 (1,392) [334] {167}	6,976 (1,395) [335] {167}
Lexington	30,717	30,760	30,813	30,887	30,966 (6,193) [1,486] {743}	31,041 (6,208) [1,490] {745}	31,112 (6,222) [1,493] {747}
Richland	42,625	42,685	42,762	42,890	43,030 (8,606) [2,065] {1,033}	43,162 (8,632) [2,072] {1,036}	43,290 (8,658) [2,078] {1,039}
Spartanburg	37,222	37,260	37,358	37,446	37,582 (7,516) [1,804] {902}	37,706 (7,541) [1,810] {905}	37,826 (7,565) [1,816] {908}
York	27,637	27,676	27,745	27,838	27,956 (5,591) [1,342] {671}	28,069 (5,614) [1,347] {674}	28,176 (5,635) [1,352] {676}

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.