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

Date: 6/15/21

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 6/15/21 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.

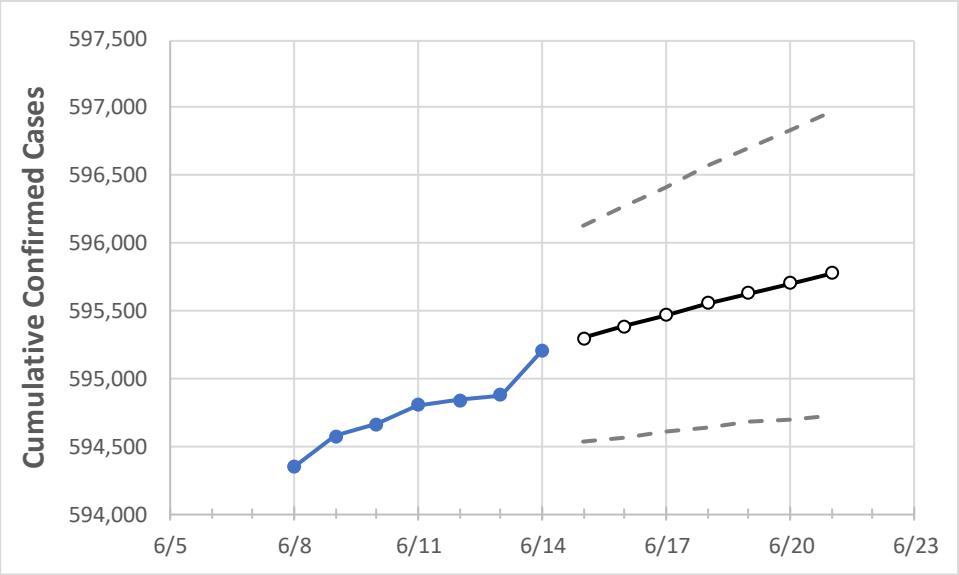
IEM's Modeling Lead

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:						
	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21
South Carolina	594,805	594,841	594,877	595,201	595,297	595,384	595,471	595,553	595,629	595,707	595,776

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:						
	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21
Beaufort	17,096	17,094	17,091	17,112	17,118	17,124	17,130	17,136	17,143	17,149	17,155
Charleston	43,894	43,888	43,881	43,896	43,902	43,908	43,914	43,920	43,925	43,931	43,936
Greenville	75,380	75,391	75,401	75,450	75,465	75,478	75,491	75,504	75,517	75,528	75,540
Kershaw	7,552	7,552	7,552	7,552	7,554	7,556	7,558	7,560	7,562	7,564	7,565
Lexington	33,698	33,698	33,697	33,717	33,723	33,729	33,734	33,739	33,744	33,749	33,754
Richland	47,332	47,334	47,336	47,364	47,377	47,390	47,402	47,414	47,426	47,438	47,449
Spartanburg	41,916	41,918	41,919	41,937	41,944	41,951	41,958	41,965	41,971	41,976	41,982
York	31,937	31,939	31,940	31,961	31,967	31,972	31,977	31,982	31,987	31,991	31,995

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:		
	6/11	6/12	6/13	6/14	6/16	6/18	6/20
Beaufort	17,096	17,094	17,091	17,112	17,124 (3,425) [822] {411}	17,136 (3,427) [823] {411}	17,149 (3,430) [823] {412}
Charleston	43,894	43,888	43,881	43,896	43,908 (8,782) [2,108] {1,054}	43,920 (8,784) [2,108] {1,054}	43,931 (8,786) [2,109] {1,054}
Greenville	75,380	75,391	75,401	75,450	75,478 (15,096) [3,623] {1,811}	75,504 (15,101) [3,624] {1,812}	75,528 (15,106) [3,625] {1,813}
Kershaw	7,552	7,552	7,552	7,552	7,556 (1,511) [363] {181}	7,560 (1,512) [363] {181}	7,564 (1,513) [363] {182}
Lexington	33,698	33,698	33,697	33,717	33,729 (6,746) [1,619] {809}	33,739 (6,748) [1,619] {810}	33,749 (6,750) [1,620] {810}
Richland	47,332	47,334	47,336	47,364	47,390 (9,478) [2,275] {1,137}	47,414 (9,483) [2,276] {1,138}	47,438 (9,488) [2,277] {1,139}
Spartanburg	41,916	41,918	41,919	41,937	41,951 (8,390) [2,014] {1,007}	41,965 (8,393) [2,014] {1,007}	41,976 (8,395) [2,015] {1,007}
York	31,937	31,939	31,940	31,961	31,972 (6,394) [1,535] {767}	31,982 (6,396) [1,535] {768}	31,991 (6,398) [1,536] {768}

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.