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

Date: 6/3/21

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 6/3/21 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.

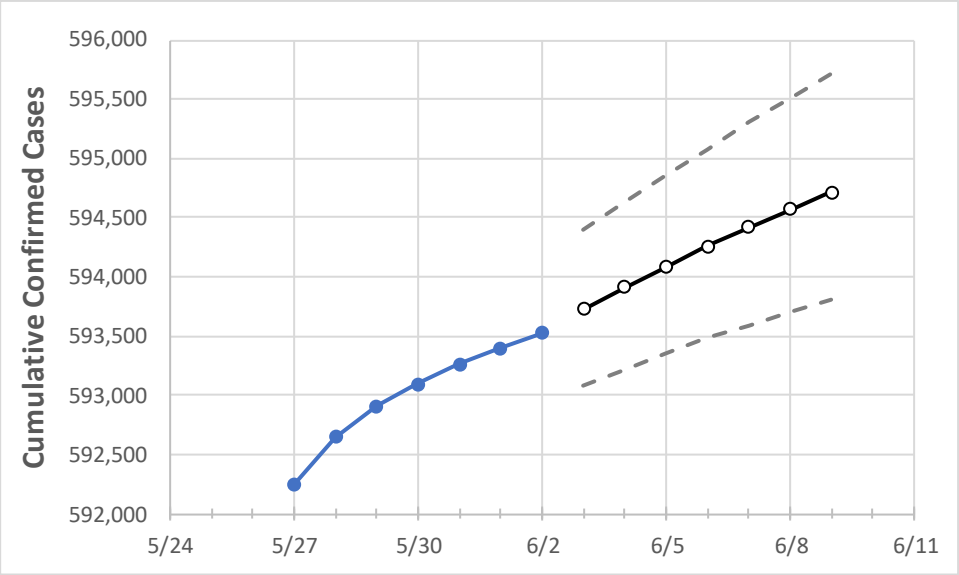
IEM's Modeling Lead

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
South Carolina	593,092	593,262	593,394	593,526	593,725	593,909	594,084	594,260	594,421	594,569	594,713

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Beaufort	17,059	17,060	17,063	17,066	17,074	17,081	17,088	17,095	17,102	17,109	17,116
Charleston	43,790	43,802	43,808	43,814	43,827	43,839	43,851	43,863	43,874	43,885	43,896
Greenville	75,162	75,176	75,190	75,203	75,223	75,242	75,260	75,277	75,293	75,309	75,324
Kershaw	7,546	7,547	7,549	7,551	7,553	7,555	7,557	7,559	7,561	7,563	7,565
Lexington	33,676	33,681	33,687	33,693	33,703	33,713	33,723	33,732	33,741	33,749	33,757
Richland	47,141	47,152	47,160	47,167	47,180	47,192	47,203	47,214	47,224	47,234	47,244
Spartanburg	41,778	41,791	41,804	41,816	41,829	41,841	41,851	41,863	41,873	41,883	41,892
York	31,858	31,880	31,895	31,909	31,931	31,952	31,972	31,993	32,012	32,031	32,049

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:		
	5/30	5/31	6/1	6/2	6/4	6/6	6/8
Beaufort	17,059	17,060	17,063	17,066	17,081 (3,416) [820] {410}	17,095 (3,419) [821] {410}	17,109 (3,422) [821] {411}
Charleston	43,790	43,802	43,808	43,814	43,839 (8,768) [2,104] {1,052}	43,863 (8,773) [2,105] {1,053}	43,885 (8,777) [2,106] {1,053}
Greenville	75,162	75,176	75,190	75,203	75,242 (15,048) [3,612] {1,806}	75,277 (15,055) [3,613] {1,807}	75,309 (15,062) [3,615] {1,807}
Kershaw	7,546	7,547	7,549	7,551	7,555 (1,511) [363] {181}	7,559 (1,512) [363] {181}	7,563 (1,513) [363] {182}
Lexington	33,676	33,681	33,687	33,693	33,713 (6,743) [1,618] {809}	33,732 (6,746) [1,619] {810}	33,749 (6,750) [1,620] {810}
Richland	47,141	47,152	47,160	47,167	47,192 (9,438) [2,265] {1,133}	47,214 (9,443) [2,266] {1,133}	47,234 (9,447) [2,267] {1,134}
Spartanburg	41,778	41,791	41,804	41,816	41,841 (8,368) [2,008] {1,004}	41,863 (8,373) [2,009] {1,005}	41,883 (8,377) [2,010] {1,005}
York	31,858	31,880	31,895	31,909	31,952 (6,390) [1,534] {767}	31,993 (6,399) [1,536] {768}	32,031 (6,406) [1,537] {769}

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.