IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/4/21

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 <u>not</u> 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 8/4/21 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
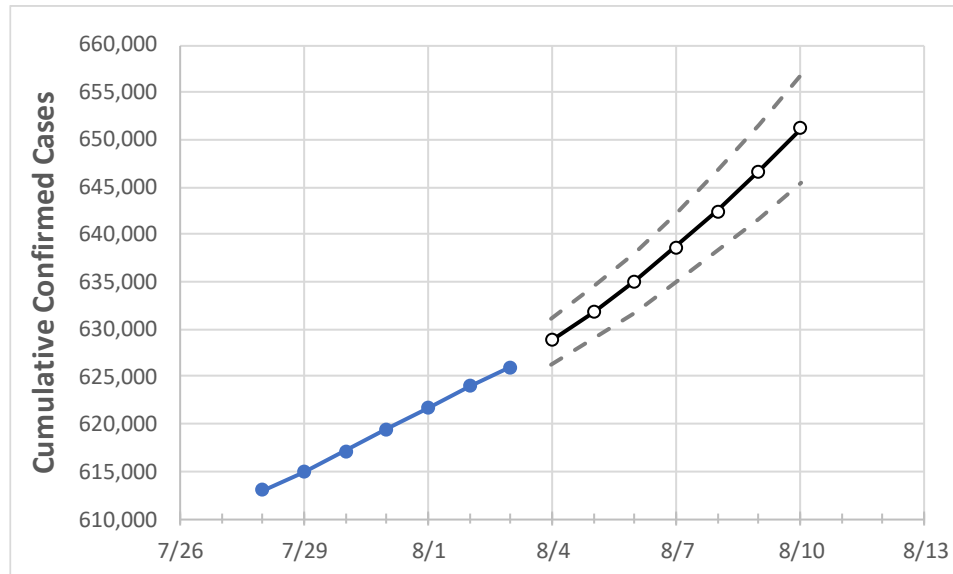
	Actual Confirmed Cases On:				Projected Cases For:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
South Carolina	619,414	621,681	623,947	626,038	628,804	631,798	635,080	638,608	642,459	646,639	651,183

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Beaufort	18,038	18,138	18,238	18,312	18,438	18,575	18,726	18,890	19,070	19,268	19,483
Charleston	45,746	45,997	46,248	46,453	46,709	46,993	47,302	47,639	48,013	48,417	48,866
Greenville	77,333	77,498	77,662	77,825	78,023	78,237	78,470	78,723	78,996	79,291	79,608
Kershaw	7,988	8,030	8,072	8,110	8,161	8,216	8,274	8,337	8,405	8,480	8,559
Lexington	35,659	35,826	35,994	36,166	36,388	36,630	36,888	37,170	37,477	37,806	38,165
Richland	49,837	50,043	50,248	50,486	50,748	51,032	51,343	51,681	52,048	52,444	52,877
Spartanburg	43,066	43,169	43,273	43,397	43,545	43,707	43,886	44,084	44,302	44,539	44,804
York	33,414	33,529	33,643	33,724	33,852	33,989	34,134	34,289	34,453	34,630	34,819

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:		
	7/31	8/1	8/2	8/3	8/5	8/7	8/9
Beaufort	18,038	18,138	18,238	18,312	18,575 (3,715) [892] {446}	18,890 (3,778) [907] {453}	19,268 (3,854) [925] {462}
Charleston	45,746	45,997	46,248	46,453	46,993 (9,399) [2,256] {1,128}	47,639 (9,528) [2,287] {1,143}	48,417 (9,683) [2,324] {1,162}
Greenville	77,333	77,498	77,662	77,825	78,237 (15,647) [3,755] {1,878}	78,723 (15,745) [3,779] {1,889}	79,291 (15,858) [3,806] {1,903}
Kershaw	7,988	8,030	8,072	8,110	8,216 (1,643) [394] {197}	8,337 (1,667) [400] {200}	8,480 (1,696) [407] {204}
Lexington	35,659	35,826	35,994	36,166	36,630 (7,326) [1,758] {879}	37,170 (7,434) [1,784] {892}	37,806 (7,561) [1,815] {907}
Richland	49,837	50,043	50,248	50,486	51,032 (10,206) [2,450] {1,225}	51,681 (10,336) [2,481] {1,240}	52,444 (10,489) [2,517] {1,259}
Spartanburg	43,066	43,169	43,273	43,397	43,707 (8,741) [2,098] {1,049}	44,084 (8,817) [2,116] {1,058}	44,539 (8,908) [2,138] {1,069}
York	33,414	33,529	33,643	33,724	33,989 (6,798) [1,631] {816}	34,289 (6,858) [1,646] {823}	34,630 (6,926) [1,662] {831}

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.