IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/20/21

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 9/20/21 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
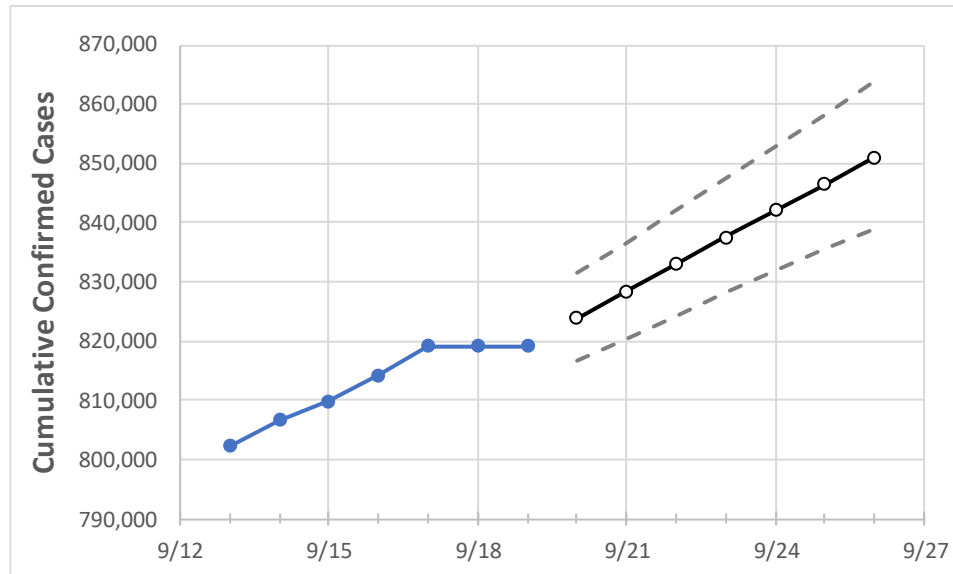
	Actual Confirmed Cases On:				Projected Cases For:						
	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26
South Carolina	814,254	819,204	819,204	819,204	823,899	828,433	832,946	837,591	842,029	846,533	851,050

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:						
	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26
Beaufort	25,342	25,485	25,485	25,485	25,604	25,720	25,835	25,951	26,063	26,175	26,290
Charleston	60,610	60,870	60,870	60,870	61,124	61,367	61,604	61,851	62,078	62,320	62,543
Greenville	95,072	95,691	95,691	95,691	96,185	96,680	97,184	97,678	98,177	98,672	99,182
Kershaw	10,789	10,858	10,858	10,858	10,918	10,981	11,045	11,107	11,169	11,230	11,295
Lexington	49,859	50,160	50,160	50,160	50,458	50,745	51,030	51,314	51,592	51,881	52,161
Richland	63,831	64,133	64,133	64,133	64,527	64,915	65,302	65,700	66,116	66,511	66,926
Spartanburg	55,313	55,641	55,641	55,641	56,028	56,415	56,791	57,189	57,574	57,970	58,368
York	42,574	42,824	42,824	42,824	43,061	43,284	43,514	43,742	43,967	44,194	44,420

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:		
	9/16	9/17	9/18	9/19	9/21	9/23	9/25
Beaufort	25,342	25,485	25,485	25,485	25,720 (5,144) [1,235] {617}	25,951 (5,190) [1,246] {623}	26,175 (5,235) [1,256] {628}
Charleston	60,610	60,870	60,870	60,870	61,367 (12,273) [2,946] {1,473}	61,851 (12,370) [2,969] {1,484}	62,320 (12,464) [2,991] {1,496}
Greenville	95,072	95,691	95,691	95,691	96,680 (19,336) [4,641] {2,320}	97,678 (19,536) [4,689] {2,344}	98,672 (19,734) [4,736] {2,368}
Kershaw	10,789	10,858	10,858	10,858	10,981 (2,196) [527] {264}	11,107 (2,221) [533] {267}	11,230 (2,246) [539] {270}
Lexington	49,859	50,160	50,160	50,160	50,745 (10,149) [2,436] {1,218}	51,314 (10,263) [2,463] {1,232}	51,881 (10,376) [2,490] {1,245}
Richland	63,831	64,133	64,133	64,133	64,915 (12,983) [3,116] {1,558}	65,700 (13,140) [3,154] {1,577}	66,511 (13,302) [3,193] {1,596}
Spartanburg	55,313	55,641	55,641	55,641	56,415 (11,283) [2,708] {1,354}	57,189 (11,438) [2,745] {1,373}	57,970 (11,594) [2,783] {1,391}
York	42,574	42,824	42,824	42,824	43,284 (8,657) [2,078] {1,039}	43,742 (8,748) [2,100] {1,050}	44,194 (8,839) [2,121] {1,061}

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.