IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/25/21

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 10/25/21 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.

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South Carolina State Projections
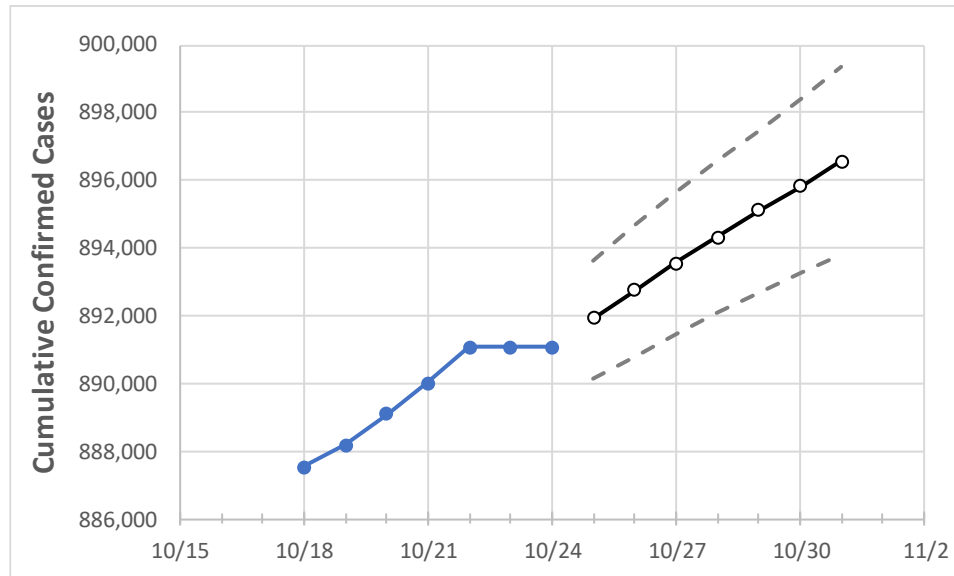
	Actual Confirmed Cases On:				Projected Cases For:						
	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31
South Carolina	890,003	891,072	891,072	891,072	891,931	892,757	893,564	894,330	895,122	895,835	896,568

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:						
	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31
Beaufort	27,051	27,072	27,072	27,072	27,090	27,108	27,124	27,140	27,155	27,171	27,186
Charleston	64,747	64,816	64,816	64,816	64,866	64,916	64,961	65,009	65,053	65,097	65,140
Greenville	104,068	104,206	104,206	104,206	104,313	104,418	104,518	104,621	104,719	104,814	104,906
Kershaw	11,885	11,894	11,894	11,894	11,905	11,916	11,925	11,935	11,945	11,954	11,962
Lexington	53,927	53,968	53,968	53,968	54,008	54,045	54,080	54,114	54,147	54,179	54,212
Richland	68,487	68,566	68,566	68,566	68,626	68,683	68,740	68,794	68,847	68,901	68,951
Spartanburg	61,266	61,343	61,343	61,343	61,401	61,458	61,510	61,563	61,616	61,666	61,712
York	46,415	46,475	46,475	46,475	46,523	46,570	46,615	46,659	46,703	46,747	46,788

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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:		
	10/21	10/22	10/23	10/24	10/26	10/28	10/30
Beaufort	27,051	27,072	27,072	27,072	27,108 (5,422) [1,301] {651}	27,140 (5,428) [1,303] {651}	27,171 (5,434) [1,304] {652}
Charleston	64,747	64,816	64,816	64,816	64,916 (12,983) [3,116] {1,558}	65,009 (13,002) [3,120] {1,560}	65,097 (13,019) [3,125] {1,562}
Greenville	104,068	104,206	104,206	104,206	104,418 (20,884) [5,012] {2,506}	104,621 (20,924) [5,022] {2,511}	104,814 (20,963) [5,031] {2,516}
Kershaw	11,885	11,894	11,894	11,894	11,916 (2,383) [572] {286}	11,935 (2,387) [573] {286}	11,954 (2,391) [574] {287}
Lexington	53,927	53,968	53,968	53,968	54,045 (10,809) [2,594] {1,297}	54,114 (10,823) [2,597] {1,299}	54,179 (10,836) [2,601] {1,300}
Richland	68,487	68,566	68,566	68,566	68,683 (13,737) [3,297] {1,648}	68,794 (13,759) [3,302] {1,651}	68,901 (13,780) [3,307] {1,654}
Spartanburg	61,266	61,343	61,343	61,343	61,458 (12,292) [2,950] {1,475}	61,563 (12,313) [2,955] {1,478}	61,666 (12,333) [2,960] {1,480}
York	46,415	46,475	46,475	46,475	46,570 (9,314) [2,235] {1,118}	46,659 (9,332) [2,240] {1,120}	46,747 (9,349) [2,244] {1,122}

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.