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

Date: 10/18/21

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 10/18/21 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.

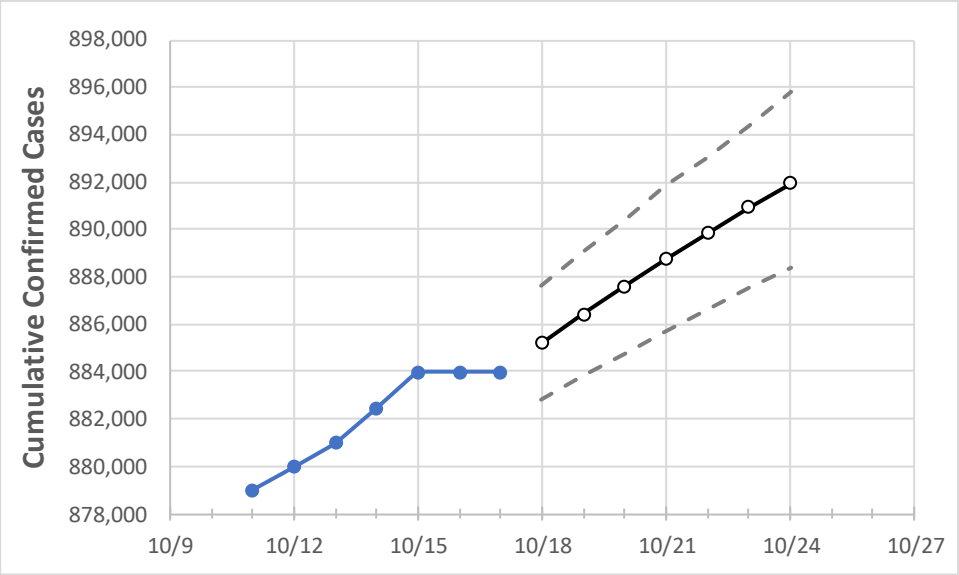
IEM's Modeling Lead

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:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
South Carolina	882,455	883,982	883,982	883,982	885,213	886,414	887,590	888,732	889,842	890,952	891,968

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:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
Beaufort	26,894	26,935	26,935	26,935	26,963	26,992	27,020	27,047	27,074	27,100	27,126
Charleston	64,310	64,400	64,400	64,400	64,468	64,533	64,595	64,657	64,719	64,776	64,832
Greenville	103,092	103,291	103,291	103,291	103,457	103,623	103,778	103,936	104,093	104,237	104,381
Kershaw	11,781	11,801	11,801	11,801	11,820	11,837	11,855	11,872	11,889	11,905	11,920
Lexington	53,557	53,628	53,628	53,628	53,697	53,761	53,823	53,884	53,944	54,004	54,061
Richland	67,983	68,074	68,074	68,074	68,151	68,230	68,302	68,375	68,446	68,515	68,581
Spartanburg	60,744	60,836	60,836	60,836	60,918	60,998	61,073	61,145	61,218	61,289	61,354
York	45,983	46,055	46,055	46,055	46,117	46,176	46,234	46,289	46,345	46,399	46,449

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:			
	10/14	10/15	10/16	10/17	10/19	10/21	10/23	
Beaufort	26,894	26,935	26,935	26,935	26,992 (5,398) [1,296] {648}	27,047 (5,409) [1,298] {649}	27,100 (5,420) [1,301] {650}	
Charleston	64,310	64,400	64,400	64,400	64,533 (12,907) [3,098] {1,549}	64,657 (12,931) [3,104] {1,552}	64,776 (12,955) [3,109] {1,555}	
Greenville	103,092	103,291	103,291	103,291	103,623 (20,725) [4,974] {2,487}	103,936 (20,787) [4,989] {2,494}	104,237 (20,847) [5,003] {2,502}	
Kershaw	11,781	11,801	11,801	11,801	11,837 (2,367) [568] {284}	11,872 (2,374) [570] {285}	11,905 (2,381) [571] {286}	
Lexington	53,557	53,628	53,628	53,628	53,761 (10,752) [2,581] {1,290}	53,884 (10,777) [2,586] {1,293}	54,004 (10,801) [2,592] {1,296}	
Richland	67,983	68,074	68,074	68,074	68,230 (13,646) [3,275] {1,638}	68,375 (13,675) [3,282] {1,641}	68,515 (13,703) [3,289] {1,644}	
Spartanburg	60,744	60,836	60,836	60,836	60,998 (12,200) [2,928] {1,464}	61,145 (12,229) [2,935] {1,467}	61,289 (12,258) [2,942] {1,471}	
York	45,983	46,055	46,055	46,055	46,176 (9,235) [2,216] {1,108}	46,289 (9,258) [2,222] {1,111}	46,399 (9,280) [2,227] {1,114}	

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.