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

Date: 10/29/21

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 10/29/21 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.

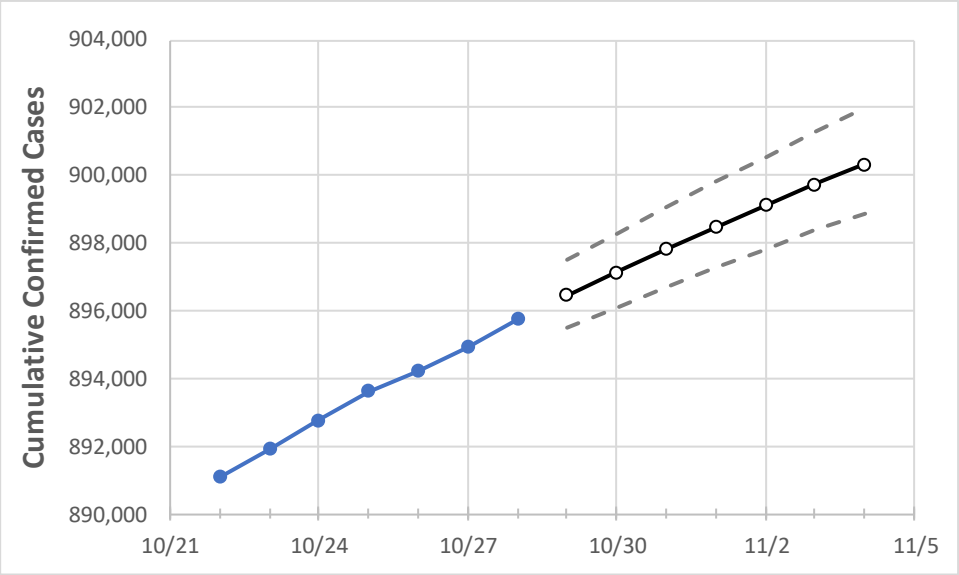
IEM's Modeling Lead

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
South Carolina	893,626	894,221	894,924	895,738	896,457	897,140	897,812	898,476	899,106	899,729	900,329

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Beaufort	27,123	27,135	27,147	27,156	27,170	27,183	27,197	27,208	27,221	27,232	27,244
Charleston	65,026	65,048	65,089	65,143	65,191	65,239	65,284	65,329	65,373	65,417	65,459
Greenville	104,577	104,667	104,746	104,862	104,961	105,058	105,150	105,242	105,331	105,419	105,504
Kershaw	11,932	11,937	11,950	11,961	11,971	11,980	11,989	11,998	12,006	12,014	12,022
Lexington	54,074	54,107	54,146	54,199	54,233	54,266	54,298	54,328	54,359	54,388	54,416
Richland	68,731	68,768	68,801	68,863	68,912	68,959	69,004	69,049	69,093	69,136	69,175
Spartanburg	61,495	61,540	61,599	61,666	61,717	61,766	61,812	61,858	61,903	61,946	61,990
York	46,610	46,650	46,686	46,729	46,770	46,809	46,850	46,886	46,923	46,959	46,995

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:			
	10/25	10/26	10/27	10/28	10/30	11/1	11/3	
Beaufort	27,123	27,135	27,147	27,156	27,183 (5,437) [1,305] {652}	27,208 (5,442) [1,306] {653}	27,232 (5,446) [1,307] {654}	
Charleston	65,026	65,048	65,089	65,143	65,239 (13,048) [3,131] {1,566}	65,329 (13,066) [3,136] {1,568}	65,417 (13,083) [3,140] {1,570}	
Greenville	104,577	104,667	104,746	104,862	105,058 (21,012) [5,043] {2,521}	105,242 (21,048) [5,052] {2,526}	105,419 (21,084) [5,060] {2,530}	
Kershaw	11,932	11,937	11,950	11,961	11,980 (2,396) [575] {288}	11,998 (2,400) [576] {288}	12,014 (2,403) [577] {288}	
Lexington	54,074	54,107	54,146	54,199	54,266 (10,853) [2,605] {1,302}	54,328 (10,866) [2,608] {1,304}	54,388 (10,878) [2,611] {1,305}	
Richland	68,731	68,768	68,801	68,863	68,959 (13,792) [3,310] {1,655}	69,049 (13,810) [3,314] {1,657}	69,136 (13,827) [3,319] {1,659}	
Spartanburg	61,495	61,540	61,599	61,666	61,766 (12,353) [2,965] {1,482}	61,858 (12,372) [2,969] {1,485}	61,946 (12,389) [2,973] {1,487}	
York	46,610	46,650	46,686	46,729	46,809 (9,362) [2,247] {1,123}	46,886 (9,377) [2,251] {1,125}	46,959 (9,392) [2,254] {1,127}	

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.