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

Date: 11/17/21

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 11/17/21 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.

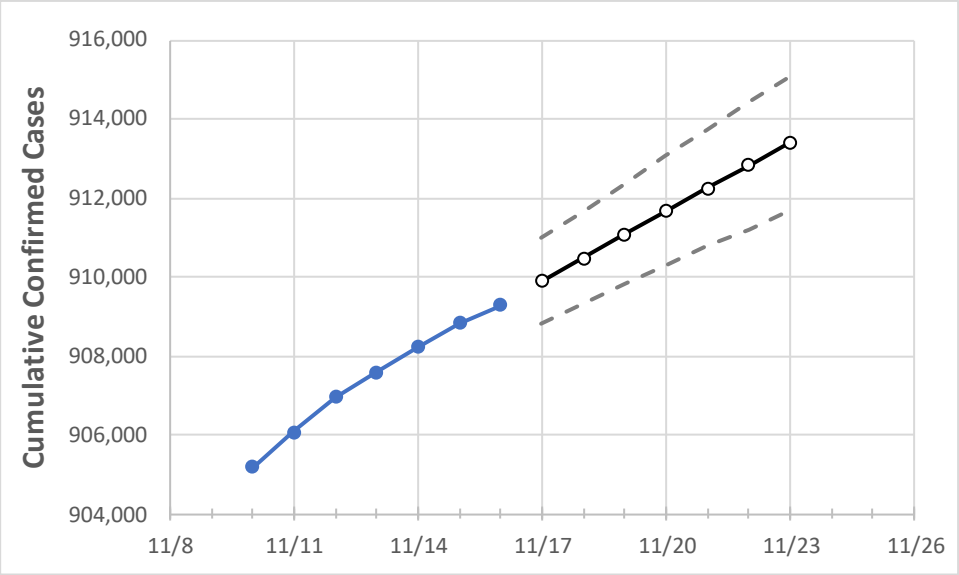
IEM's Modeling Lead

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
South Carolina	907,576	908,208	908,839	909,288	909,887	910,483	911,089	911,672	912,244	912,835	913,403

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Beaufort	27,440	27,448	27,455	27,464	27,475	27,486	27,496	27,506	27,517	27,527	27,537
Charleston	65,910	65,958	66,006	66,039	66,083	66,123	66,165	66,206	66,247	66,287	66,329
Greenville	106,387	106,471	106,556	106,619	106,700	106,778	106,855	106,934	107,012	107,088	107,163
Kershaw	12,109	12,117	12,124	12,131	12,138	12,145	12,153	12,159	12,166	12,173	12,180
Lexington	54,845	54,879	54,913	54,945	54,980	55,013	55,047	55,079	55,112	55,145	55,177
Richland	69,606	69,649	69,692	69,719	69,756	69,793	69,828	69,864	69,901	69,937	69,971
Spartanburg	62,474	62,516	62,557	62,587	62,625	62,660	62,695	62,731	62,766	62,800	62,834
York	47,432	47,477	47,523	47,560	47,609	47,656	47,707	47,757	47,808	47,858	47,911

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:			
	11/13	11/14	11/15	11/16	11/18	11/20	11/22	
Beaufort	27,440	27,448	27,455	27,464	27,486 (5,497) [1,319] {660}	27,506 (5,501) [1,320] {660}	27,527 (5,505) [1,321] {661}	
Charleston	65,910	65,958	66,006	66,039	66,123 (13,225) [3,174] {1,587}	66,206 (13,241) [3,178] {1,589}	66,287 (13,257) [3,182] {1,591}	
Greenville	106,387	106,471	106,556	106,619	106,778 (21,356) [5,125] {2,563}	106,934 (21,387) [5,133] {2,566}	107,088 (21,418) [5,140] {2,570}	
Kershaw	12,109	12,117	12,124	12,131	12,145 (2,429) [583] {291}	12,159 (2,432) [584] {292}	12,173 (2,435) [584] {292}	
Lexington	54,845	54,879	54,913	54,945	55,013 (11,003) [2,641] {1,320}	55,079 (11,016) [2,644] {1,322}	55,145 (11,029) [2,647] {1,323}	
Richland	69,606	69,649	69,692	69,719	69,793 (13,959) [3,350] {1,675}	69,864 (13,973) [3,353] {1,677}	69,937 (13,987) [3,357] {1,678}	
Spartanburg	62,474	62,516	62,557	62,587	62,660 (12,532) [3,008] {1,504}	62,731 (12,546) [3,011] {1,506}	62,800 (12,560) [3,014] {1,507}	
York	47,432	47,477	47,523	47,560	47,656 (9,531) [2,287] {1,144}	47,757 (9,551) [2,292] {1,146}	47,858 (9,572) [2,297] {1,149}	

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.