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

Date: 9/22/21

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 9/22/21 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.

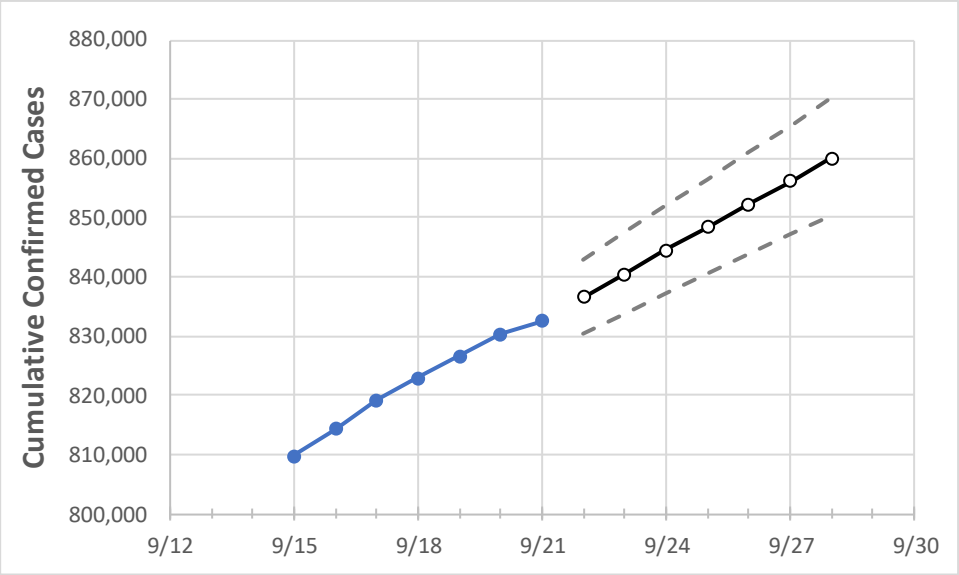
IEM's Modeling Lead

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
South Carolina	822,889	826,575	830,260	832,466	836,527	840,443	844,508	848,367	852,289	856,175	859,985

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Beaufort	25,575	25,664	25,754	25,812	25,915	26,016	26,116	26,213	26,311	26,409	26,499
Charleston	61,059	61,248	61,437	61,576	61,794	62,004	62,204	62,401	62,595	62,791	62,982
Greenville	96,143	96,594	97,046	97,273	97,708	98,166	98,599	99,053	99,496	99,934	100,380
Kershaw	10,903	10,948	10,993	11,030	11,088	11,142	11,199	11,256	11,311	11,368	11,421
Lexington	50,362	50,565	50,767	50,892	51,146	51,393	51,633	51,872	52,108	52,337	52,567
Richland	64,341	64,549	64,757	64,918	65,247	65,579	65,911	66,246	66,569	66,922	67,249
Spartanburg	55,941	56,240	56,540	56,675	57,001	57,335	57,658	57,987	58,313	58,643	58,982
York	43,000	43,177	43,353	43,473	43,671	43,865	44,054	44,240	44,430	44,615	44,798

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:		
	9/18	9/19	9/20	9/21	9/23	9/25	9/27
Beaufort	25,575	25,664	25,754	25,812	26,016 (5,203) [1,249] {624}	26,213 (5,243) [1,258] {629}	26,409 (5,282) [1,268] {634}
Charleston	61,059	61,248	61,437	61,576	62,004 (12,401) [2,976] {1,488}	62,401 (12,480) [2,995] {1,498}	62,791 (12,558) [3,014] {1,507}
Greenville	96,143	96,594	97,046	97,273	98,166 (19,633) [4,712] {2,356}	99,053 (19,811) [4,755] {2,377}	99,934 (19,987) [4,797] {2,398}
Kershaw	10,903	10,948	10,993	11,030	11,142 (2,228) [535] {267}	11,256 (2,251) [540] {270}	11,368 (2,274) [546] {273}
Lexington	50,362	50,565	50,767	50,892	51,393 (10,279) [2,467] {1,233}	51,872 (10,374) [2,490] {1,245}	52,337 (10,467) [2,512] {1,256}
Richland	64,341	64,549	64,757	64,918	65,579 (13,116) [3,148] {1,574}	66,246 (13,249) [3,180] {1,590}	66,922 (13,384) [3,212] {1,606}
Spartanburg	55,941	56,240	56,540	56,675	57,335 (11,467) [2,752] {1,376}	57,987 (11,597) [2,783] {1,392}	58,643 (11,729) [2,815] {1,407}
York	43,000	43,177	43,353	43,473	43,865 (8,773) [2,106] {1,053}	44,240 (8,848) [2,124] {1,062}	44,615 (8,923) [2,142] {1,071}

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.