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

Date: 9/24/21

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 9/24/21 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.

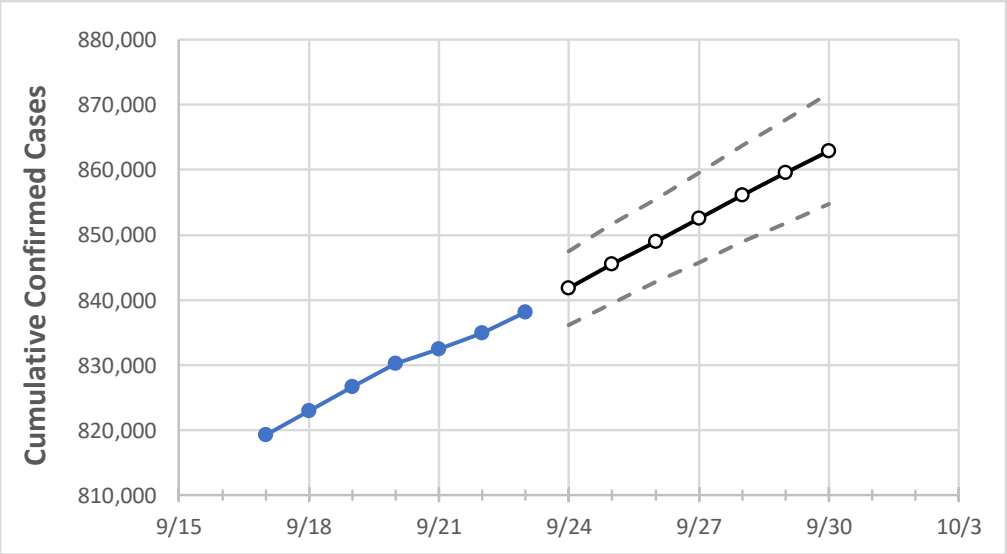
IEM's Modeling Lead

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
South Carolina	830,260	832,466	834,880	838,079	841,796	845,443	848,957	852,472	856,091	859,498	862,914

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Beaufort	25,754	25,812	25,846	25,931	26,023	26,111	26,197	26,286	26,369	26,454	26,537
Charleston	61,437	61,576	61,705	61,927	62,125	62,313	62,494	62,682	62,855	63,041	63,209
Greenville	97,046	97,273	97,586	97,935	98,363	98,793	99,206	99,613	100,023	100,442	100,850
Kershaw	10,993	11,030	11,057	11,102	11,154	11,207	11,257	11,306	11,356	11,407	11,459
Lexington	50,767	50,892	51,010	51,208	51,428	51,645	51,855	52,061	52,269	52,463	52,660
Richland	64,757	64,918	65,061	65,228	65,533	65,828	66,132	66,425	66,721	67,032	67,332
Spartanburg	56,540	56,675	56,864	57,041	57,345	57,651	57,945	58,240	58,534	58,847	59,129
York	43,353	43,473	43,589	43,745	43,922	44,102	44,271	44,441	44,612	44,781	44,949

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:		
	9/20	9/21	9/22	9/23	9/25	9/27	9/29
Beaufort	25,754	25,812	25,846	25,931	26,111 (5,222) [1,253] {627}	26,286 (5,257) [1,262] {631}	26,454 (5,291) [1,270] {635}
Charleston	61,437	61,576	61,705	61,927	62,313 (12,463) [2,991] {1,496}	62,682 (12,536) [3,009] {1,504}	63,041 (12,608) [3,026] {1,513}
Greenville	97,046	97,273	97,586	97,935	98,793 (19,759) [4,742] {2,371}	99,613 (19,923) [4,781] {2,391}	100,442 (20,088) [4,821] {2,411}
Kershaw	10,993	11,030	11,057	11,102	11,207 (2,241) [538] {269}	11,306 (2,261) [543] {271}	11,407 (2,281) [548] {274}
Lexington	50,767	50,892	51,010	51,208	51,645 (10,329) [2,479] {1,239}	52,061 (10,412) [2,499] {1,249}	52,463 (10,493) [2,518] {1,259}
Richland	64,757	64,918	65,061	65,228	65,828 (13,166) [3,160] {1,580}	66,425 (13,285) [3,188] {1,594}	67,032 (13,406) [3,218] {1,609}
Spartanburg	56,540	56,675	56,864	57,041	57,651 (11,530) [2,767] {1,384}	58,240 (11,648) [2,796] {1,398}	58,847 (11,769) [2,825] {1,412}
York	43,353	43,473	43,589	43,745	44,102 (8,820) [2,117] {1,058}	44,441 (8,888) [2,133] {1,067}	44,781 (8,956) [2,149] {1,075}

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.