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

Date: 9/27/21

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 9/27/21 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.

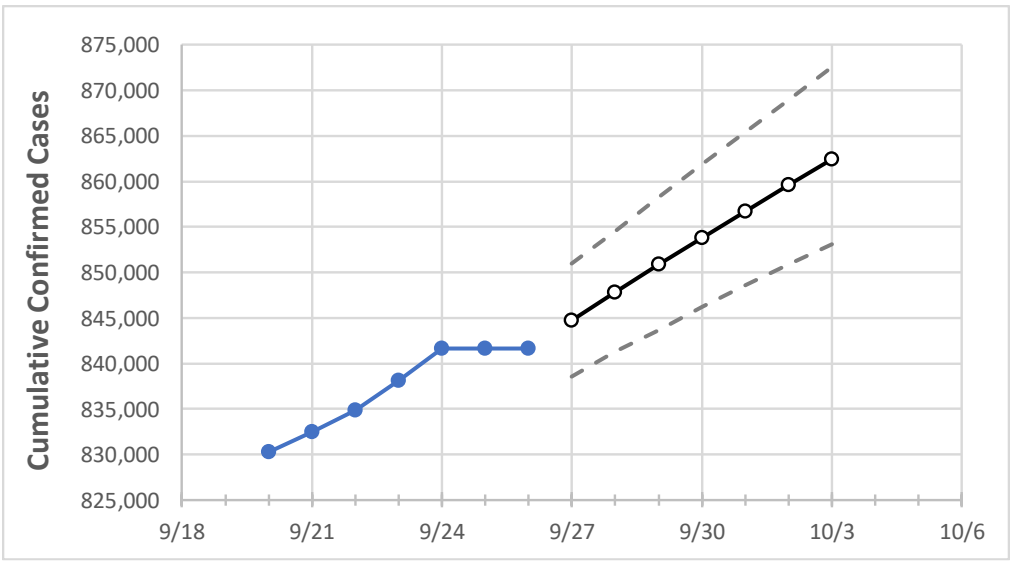
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
South Carolina	838,079	841,600	841,600	841,600	844,736	847,776	850,852	853,748	856,719	859,618	862,380

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Beaufort	25,931	26,007	26,007	26,007	26,081	26,152	26,218	26,286	26,353	26,417	26,478
Charleston	61,927	62,093	62,093	62,093	62,262	62,433	62,595	62,750	62,909	63,063	63,207
Greenville	97,935	98,359	98,359	98,359	98,738	99,128	99,487	99,864	100,213	100,577	100,934
Kershaw	11,102	11,150	11,150	11,150	11,188	11,228	11,266	11,303	11,339	11,376	11,410
Lexington	51,208	51,422	51,422	51,422	51,590	51,753	51,917	52,065	52,222	52,374	52,517
Richland	65,228	65,487	65,487	65,487	65,686	65,876	66,060	66,239	66,415	66,593	66,758
Spartanburg	57,041	57,342	57,342	57,342	57,604	57,864	58,119	58,367	58,623	58,866	59,108
York	43,745	43,890	43,890	43,890	44,036	44,177	44,316	44,448	44,585	44,712	44,846

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:		
	9/23	9/24	9/25	9/26	9/28	9/30	10/2
Beaufort	25,931	26,007	26,007	26,007	26,152 (5,230) [1,255] {628}	26,286 (5,257) [1,262] {631}	26,417 (5,283) [1,268] {634}
Charleston	61,927	62,093	62,093	62,093	62,433 (12,487) [2,997] {1,498}	62,750 (12,550) [3,012] {1,506}	63,063 (12,613) [3,027] {1,514}
Greenville	97,935	98,359	98,359	98,359	99,128 (19,826) [4,758] {2,379}	99,864 (19,973) [4,793] {2,397}	100,577 (20,115) [4,828] {2,414}
Kershaw	11,102	11,150	11,150	11,150	11,228 (2,246) [539] {269}	11,303 (2,261) [543] {271}	11,376 (2,275) [546] {273}
Lexington	51,208	51,422	51,422	51,422	51,753 (10,351) [2,484] {1,242}	52,065 (10,413) [2,499] {1,250}	52,374 (10,475) [2,514] {1,257}
Richland	65,228	65,487	65,487	65,487	65,876 (13,175) [3,162] {1,581}	66,239 (13,248) [3,179] {1,590}	66,593 (13,319) [3,196] {1,598}
Spartanburg	57,041	57,342	57,342	57,342	57,864 (11,573) [2,777] {1,389}	58,367 (11,673) [2,802] {1,401}	58,866 (11,773) [2,826] {1,413}
York	43,745	43,890	43,890	43,890	44,177 (8,835) [2,120] {1,060}	44,448 (8,890) [2,134] {1,067}	44,712 (8,942) [2,146] {1,073}

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.