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

Date: 9/15/21

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 9/15/21 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.

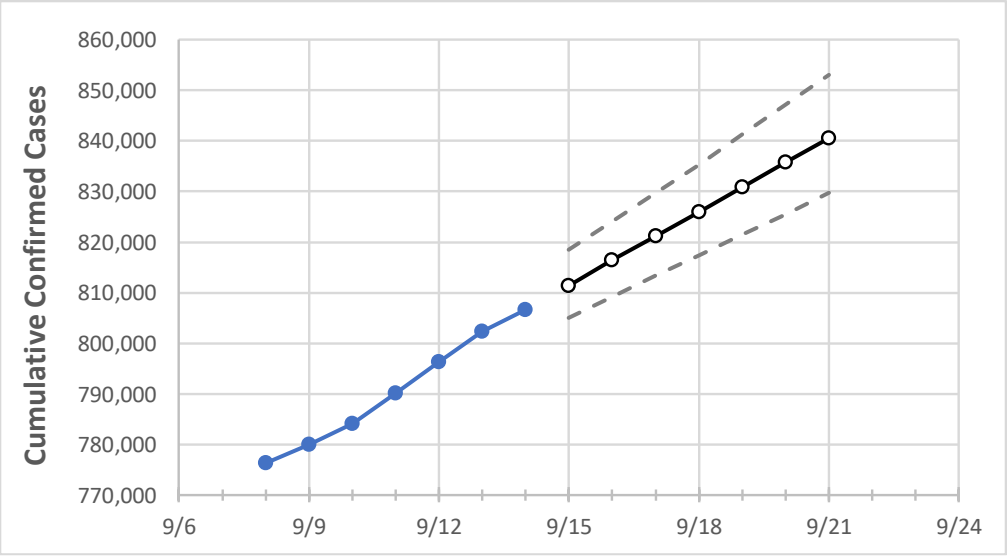
IEM's Modeling Lead

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:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
South Carolina	790,144	796,236	802,328	806,597	811,403	816,362	821,143	825,984	830,859	835,797	840,586

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:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
Beaufort	24,688	24,864	25,041	25,150	25,281	25,414	25,542	25,667	25,793	25,919	26,048
Charleston	59,175	59,496	59,816	60,153	60,435	60,715	60,983	61,253	61,522	61,785	62,047
Greenville	92,640	93,284	93,927	94,286	94,798	95,309	95,814	96,327	96,838	97,361	97,886
Kershaw	10,475	10,563	10,651	10,696	10,763	10,829	10,894	10,959	11,027	11,095	11,162
Lexington	48,312	48,712	49,111	49,370	49,711	50,041	50,367	50,705	51,028	51,352	51,680
Richland	61,691	62,393	63,096	63,346	63,763	64,170	64,593	65,010	65,449	65,896	66,351
Spartanburg	53,256	53,715	54,175	54,501	54,883	55,260	55,633	56,017	56,402	56,798	57,188
York	41,426	41,689	41,953	42,235	42,503	42,766	43,033	43,295	43,567	43,837	44,106

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:		
	9/11	9/12	9/13	9/14	9/16	9/18	9/20
Beaufort	24,688	24,864	25,041	25,150	25,414 (5,083) [1,220] {610}	25,667 (5,133) [1,232] {616}	25,919 (5,184) [1,244] {622}
Charleston	59,175	59,496	59,816	60,153	60,715 (12,143) [2,914] {1,457}	61,253 (12,251) [2,940] {1,470}	61,785 (12,357) [2,966] {1,483}
Greenville	92,640	93,284	93,927	94,286	95,309 (19,062) [4,575] {2,287}	96,327 (19,265) [4,624] {2,312}	97,361 (19,472) [4,673] {2,337}
Kershaw	10,475	10,563	10,651	10,696	10,829 (2,166) [520] {260}	10,959 (2,192) [526] {263}	11,095 (2,219) [533] {266}
Lexington	48,312	48,712	49,111	49,370	50,041 (10,008) [2,402] {1,201}	50,705 (10,141) [2,434] {1,217}	51,352 (10,270) [2,465] {1,232}
Richland	61,691	62,393	63,096	63,346	64,170 (12,834) [3,080] {1,540}	65,010 (13,002) [3,121] {1,560}	65,896 (13,179) [3,163] {1,581}
Spartanburg	53,256	53,715	54,175	54,501	55,260 (11,052) [2,652] {1,326}	56,017 (11,203) [2,689] {1,344}	56,798 (11,360) [2,726] {1,363}
York	41,426	41,689	41,953	42,235	42,766 (8,553) [2,053] {1,026}	43,295 (8,659) [2,078] {1,039}	43,837 (8,767) [2,104] {1,052}

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.