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

Date: 9/17/21

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 9/17/21 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.

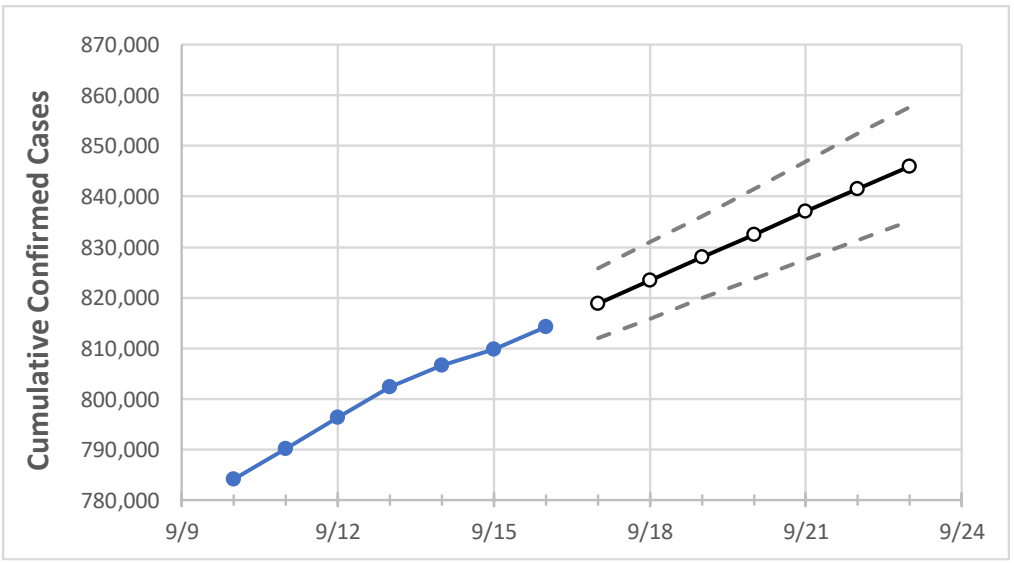
IEM's Modeling Lead

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:						
	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23
South Carolina	802,328	806,597	809,779	814,254	818,765	823,399	827,959	832,446	836,982	841,564	845,932

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:						
	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23
Beaufort	25,041	25,150	25,252	25,342	25,462	25,580	25,699	25,814	25,924	26,043	26,151
Charleston	59,816	60,153	60,331	60,610	60,873	61,130	61,378	61,634	61,884	62,130	62,363
Greenville	93,927	94,286	94,553	95,072	95,565	96,047	96,530	97,016	97,498	97,987	98,480
Kershaw	10,651	10,696	10,731	10,789	10,851	10,914	10,974	11,038	11,100	11,164	11,229
Lexington	49,111	49,370	49,600	49,859	50,171	50,475	50,776	51,080	51,377	51,677	51,985
Richland	63,096	63,346	63,560	63,831	64,207	64,609	65,007	65,395	65,793	66,207	66,596
Spartanburg	54,175	54,501	54,823	55,313	55,697	56,085	56,471	56,863	57,269	57,666	58,062
York	41,953	42,235	42,414	42,574	42,815	43,054	43,293	43,532	43,767	44,004	44,244

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:		
	9/13	9/14	9/15	9/16	9/18	9/20	9/22
Beaufort	25,041	25,150	25,252	25,342	25,580 (5,116) [1,228] {614}	25,814 (5,163) [1,239] {620}	26,043 (5,209) [1,250] {625}
Charleston	59,816	60,153	60,331	60,610	61,130 (12,226) [2,934] {1,467}	61,634 (12,327) [2,958] {1,479}	62,130 (12,426) [2,982] {1,491}
Greenville	93,927	94,286	94,553	95,072	96,047 (19,209) [4,610] {2,305}	97,016 (19,403) [4,657] {2,328}	97,987 (19,597) [4,703] {2,352}
Kershaw	10,651	10,696	10,731	10,789	10,914 (2,183) [524] {262}	11,038 (2,208) [530] {265}	11,164 (2,233) [536] {268}
Lexington	49,111	49,370	49,600	49,859	50,475 (10,095) [2,423] {1,211}	51,080 (10,216) [2,452] {1,226}	51,677 (10,335) [2,481] {1,240}
Richland	63,096	63,346	63,560	63,831	64,609 (12,922) [3,101] {1,551}	65,395 (13,079) [3,139] {1,569}	66,207 (13,241) [3,178] {1,589}
Spartanburg	54,175	54,501	54,823	55,313	56,085 (11,217) [2,692] {1,346}	56,863 (11,373) [2,729] {1,365}	57,666 (11,533) [2,768] {1,384}
York	41,953	42,235	42,414	42,574	43,054 (8,611) [2,067] {1,033}	43,532 (8,706) [2,090] {1,045}	44,004 (8,801) [2,112] {1,056}

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.