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

Date: 9/29/21

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 9/29/21 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.

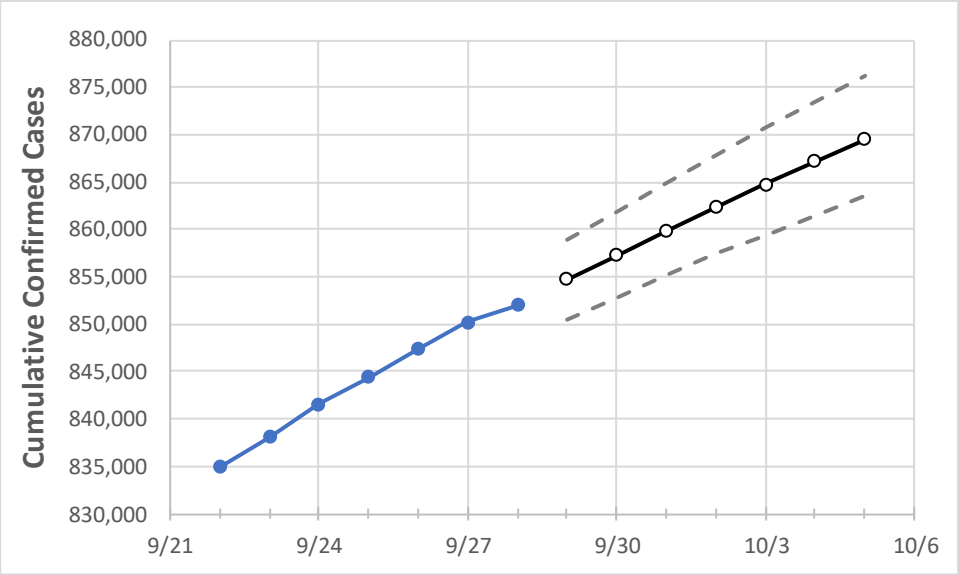
IEM's Modeling Lead

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
South Carolina	844,463	847,325	850,188	852,006	854,738	857,338	859,832	862,313	864,735	867,203	869,483

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Beaufort	26,064	26,120	26,177	26,212	26,270	26,326	26,379	26,432	26,482	26,534	26,582
Charleston	62,256	62,420	62,583	62,669	62,817	62,959	63,094	63,228	63,359	63,490	63,614
Greenville	98,691	99,022	99,354	99,565	99,901	100,234	100,554	100,865	101,187	101,495	101,798
Kershaw	11,193	11,235	11,278	11,300	11,336	11,372	11,406	11,439	11,473	11,507	11,537
Lexington	51,575	51,728	51,881	51,987	52,131	52,270	52,402	52,533	52,658	52,779	52,899
Richland	65,667	65,848	66,028	66,134	66,290	66,441	66,584	66,725	66,865	67,001	67,131
Spartanburg	57,553	57,765	57,976	58,152	58,377	58,596	58,814	59,018	59,234	59,438	59,642
York	44,057	44,225	44,392	44,515	44,658	44,789	44,921	45,052	45,176	45,300	45,423

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:											
	9/25	9/26	9/27	9/28	9/30				10/2				10/4			
Beaufort	26,064	26,120	26,177	26,212	26,326	(5,265)	[1,264]	{632}	26,432	(5,286)	[1,269]	{634}	26,534	(5,307)	[1,274]	{637}
Charleston	62,256	62,420	62,583	62,669	62,959	(12,592)	[3,022]	{1,511}	63,228	(12,646)	[3,035]	{1,517}	63,490	(12,698)	[3,048]	{1,524}
Greenville	98,691	99,022	99,354	99,565	100,234	(20,047)	[4,811]	{2,406}	100,865	(20,173)	[4,841]	{2,421}	101,495	(20,299)	[4,872]	{2,436}
Kershaw	11,193	11,235	11,278	11,300	11,372	(2,274)	[546]	{273}	11,439	(2,288)	[549]	{275}	11,507	(2,301)	[552]	{276}
Lexington	51,575	51,728	51,881	51,987	52,270	(10,454)	[2,509]	{1,254}	52,533	(10,507)	[2,522]	{1,261}	52,779	(10,556)	[2,533]	{1,267}
Richland	65,667	65,848	66,028	66,134	66,441	(13,288)	[3,189]	{1,595}	66,725	(13,345)	[3,203]	{1,601}	67,001	(13,400)	[3,216]	{1,608}
Spartanburg	57,553	57,765	57,976	58,152	58,596	(11,719)	[2,813]	{1,406}	59,018	(11,804)	[2,833]	{1,416}	59,438	(11,888)	[2,853]	{1,427}
York	44,057	44,225	44,392	44,515	44,789	(8,958)	[2,150]	{1,075}	45,052	(9,010)	[2,162]	{1,081}	45,300	(9,060)	[2,174]	{1,087}

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.