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

Date: 10/6/21

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 10/6/21 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.

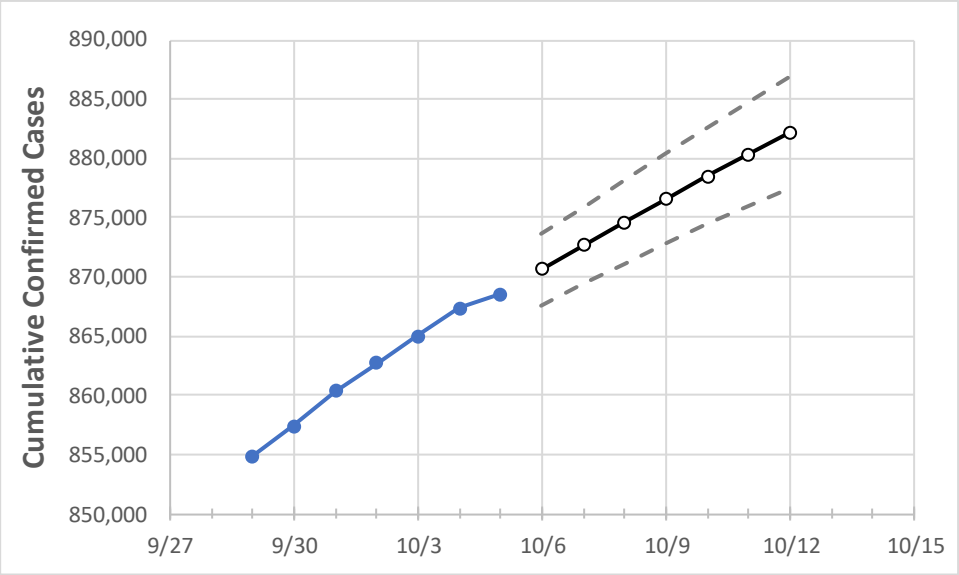
IEM's Modeling Lead

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
South Carolina	862,684	865,000	867,315	868,574	870,678	872,664	874,644	876,554	878,493	880,356	882,181

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Beaufort	26,455	26,499	26,544	26,567	26,608	26,648	26,687	26,726	26,762	26,798	26,833
Charleston	63,222	63,366	63,510	63,585	63,701	63,813	63,919	64,027	64,131	64,234	64,335
Greenville	100,618	100,885	101,153	101,301	101,525	101,745	101,963	102,171	102,381	102,573	102,763
Kershaw	11,473	11,516	11,558	11,578	11,614	11,648	11,682	11,717	11,750	11,783	11,816
Lexington	52,495	52,615	52,734	52,792	52,892	52,990	53,087	53,176	53,264	53,351	53,435
Richland	66,741	66,874	67,006	67,098	67,223	67,345	67,465	67,584	67,699	67,809	67,917
Spartanburg	59,306	59,469	59,631	59,759	59,935	60,130	60,326	60,501	60,683	60,866	61,035
York	44,990	45,110	45,231	45,293	45,401	45,505	45,604	45,705	45,805	45,901	45,994

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:											
	10/2	10/3	10/4	10/5	10/7				10/9				10/11			
Beaufort	26,455	26,499	26,544	26,567	26,648	(5,330)	[1,279]	{640}	26,726	(5,345)	[1,283]	{641}	26,798	(5,360)	[1,286]	{643}
Charleston	63,222	63,366	63,510	63,585	63,813	(12,763)	[3,063]	{1,532}	64,027	(12,805)	[3,073]	{1,537}	64,234	(12,847)	[3,083]	{1,542}
Greenville	100,618	100,885	101,153	101,301	101,745	(20,349)	[4,884]	{2,442}	102,171	(20,434)	[4,904]	{2,452}	102,573	(20,515)	[4,924]	{2,462}
Kershaw	11,473	11,516	11,558	11,578	11,648	(2,330)	[559]	{280}	11,717	(2,343)	[562]	{281}	11,783	(2,357)	[566]	{283}
Lexington	52,495	52,615	52,734	52,792	52,990	(10,598)	[2,544]	{1,272}	53,176	(10,635)	[2,552]	{1,276}	53,351	(10,670)	[2,561]	{1,280}
Richland	66,741	66,874	67,006	67,098	67,345	(13,469)	[3,233]	{1,616}	67,584	(13,517)	[3,244]	{1,622}	67,809	(13,562)	[3,255]	{1,627}
Spartanburg	59,306	59,469	59,631	59,759	60,130	(12,026)	[2,886]	{1,443}	60,501	(12,100)	[2,904]	{1,452}	60,866	(12,173)	[2,922]	{1,461}
York	44,990	45,110	45,231	45,293	45,505	(9,101)	[2,184]	{1,092}	45,705	(9,141)	[2,194]	{1,097}	45,901	(9,180)	[2,203]	{1,102}

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.