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

Date: 11/5/21

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 11/5/21 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.

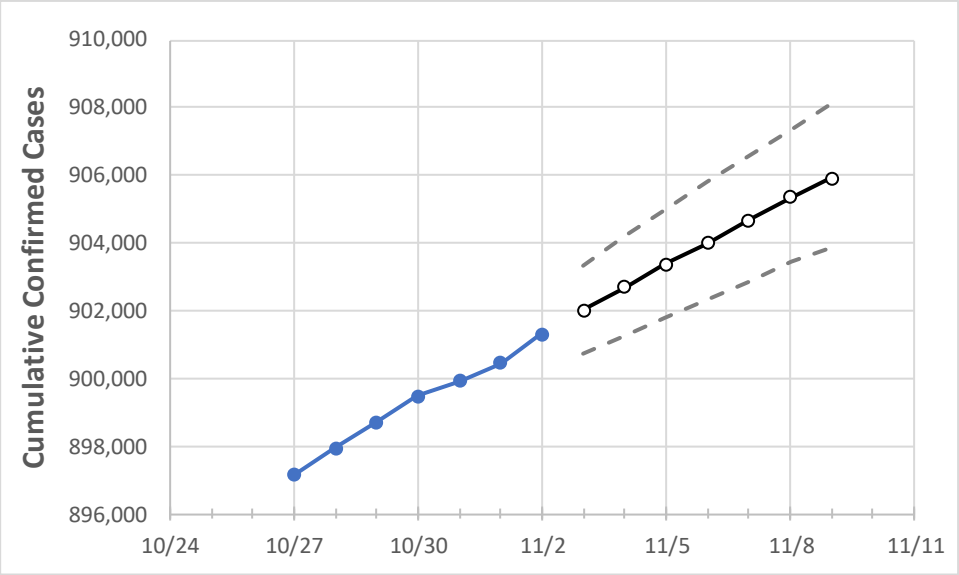
IEM's Modeling Lead

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
South Carolina	899,481	899,912	900,464	901,314	902,012	902,686	903,360	904,008	904,685	905,340	905,923

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Beaufort	27,265	27,275	27,287	27,321	27,338	27,354	27,371	27,387	27,403	27,420	27,435
Charleston	65,382	65,408	65,430	65,480	65,526	65,571	65,615	65,659	65,702	65,744	65,789
Greenville	105,335	105,394	105,461	105,562	105,652	105,742	105,829	105,914	106,000	106,084	106,166
Kershaw	12,006	12,013	12,019	12,033	12,042	12,051	12,059	12,068	12,077	12,085	12,093
Lexington	54,415	54,429	54,474	54,512	54,550	54,588	54,625	54,663	54,699	54,734	54,770
Richland	69,101	69,134	69,170	69,247	69,293	69,340	69,386	69,427	69,470	69,518	69,558
Spartanburg	61,961	61,999	62,033	62,083	62,137	62,188	62,237	62,289	62,339	62,389	62,435
York	46,880	46,902	46,937	46,972	47,003	47,033	47,063	47,091	47,120	47,147	47,174

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:											
	10/30	10/31	11/1	11/2	11/4				11/6				11/8			
Beaufort	27,265	27,275	27,287	27,321	27,354	(5,471)	[1,313]	{656}	27,387	(5,477)	[1,315]	{657}	27,420	(5,484)	[1,316]	{658}
Charleston	65,382	65,408	65,430	65,480	65,571	(13,114)	[3,147]	{1,574}	65,659	(13,132)	[3,152]	{1,576}	65,744	(13,149)	[3,156]	{1,578}
Greenville	105,335	105,394	105,461	105,562	105,742	(21,148)	[5,076]	{2,538}	105,914	(21,183)	[5,084]	{2,542}	106,084	(21,217)	[5,092]	{2,546}
Kershaw	12,006	12,013	12,019	12,033	12,051	(2,410)	[578]	{289}	12,068	(2,414)	[579]	{290}	12,085	(2,417)	[580]	{290}
Lexington	54,415	54,429	54,474	54,512	54,588	(10,918)	[2,620]	{1,310}	54,663	(10,933)	[2,624]	{1,312}	54,734	(10,947)	[2,627]	{1,314}
Richland	69,101	69,134	69,170	69,247	69,340	(13,868)	[3,328]	{1,664}	69,427	(13,885)	[3,333]	{1,666}	69,518	(13,904)	[3,337]	{1,668}
Spartanburg	61,961	61,999	62,033	62,083	62,188	(12,438)	[2,985]	{1,493}	62,289	(12,458)	[2,990]	{1,495}	62,389	(12,478)	[2,995]	{1,497}
York	46,880	46,902	46,937	46,972	47,033	(9,407)	[2,258]	{1,129}	47,091	(9,418)	[2,260]	{1,130}	47,147	(9,429)	[2,263]	{1,132}

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.