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

Date: 1/7/22

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 1/7/22 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.

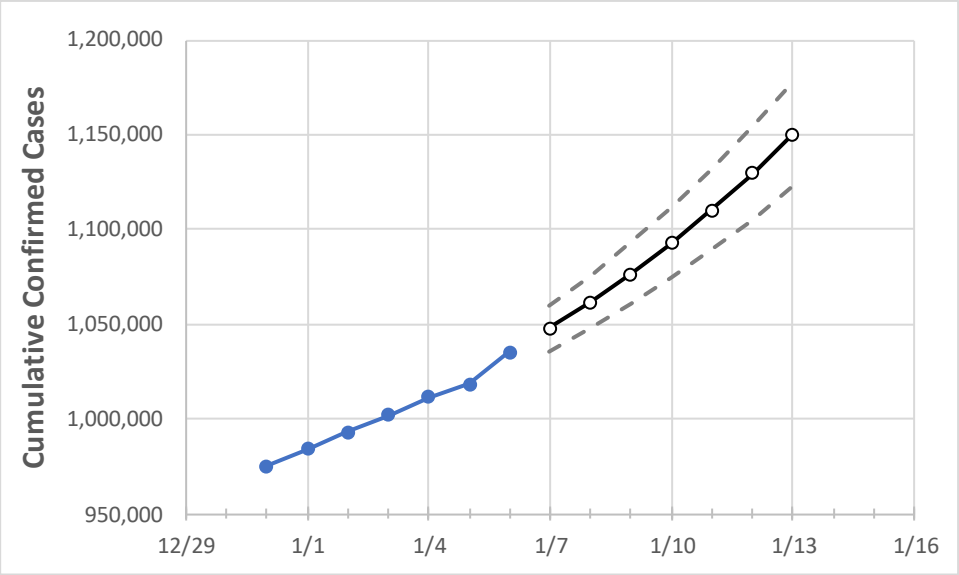
IEM's Modeling Lead

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
South Carolina	1,002,283	1,011,271	1,018,435	1,035,256	1,047,962	1,061,790	1,076,654	1,092,912	1,110,347	1,129,897	1,150,325

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Beaufort	29,506	29,688	29,808	30,288	30,603	30,931	31,300	31,694	32,142	32,622	33,146
Charleston	74,740	75,669	76,452	78,131	79,504	80,987	82,631	84,395	86,334	88,431	90,704
Greenville	117,888	118,977	119,687	121,769	123,300	124,959	126,753	128,662	130,789	133,074	135,533
Kershaw	13,769	13,919	14,042	14,336	14,541	14,765	15,004	15,260	15,538	15,837	16,155
Lexington	61,384	62,027	62,667	63,788	64,762	65,814	66,951	68,182	69,547	71,005	72,592
Richland	79,763	80,959	81,927	83,761	85,474	87,386	89,439	91,686	94,112	96,806	99,696
Spartanburg	67,225	67,639	67,989	68,878	69,471	70,115	70,800	71,553	72,356	73,215	74,161
York	53,158	53,661	54,011	54,802	55,381	56,020	56,696	57,408	58,173	59,015	59,877

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:											
	1/3	1/4	1/5	1/6	1/8				1/10				1/12			
Beaufort	29,506	29,688	29,808	30,288	30,931	(6,186)	[1,485]	{742}	31,694	(6,339)	[1,521]	{761}	32,622	(6,524)	[1,566]	{783}
Charleston	74,740	75,669	76,452	78,131	80,987	(16,197)	[3,887]	{1,944}	84,395	(16,879)	[4,051]	{2,025}	88,431	(17,686)	[4,245]	{2,122}
Greenville	117,888	118,977	119,687	121,769	124,959	(24,992)	[5,998]	{2,999}	128,662	(25,732)	[6,176]	{3,088}	133,074	(26,615)	[6,388]	{3,194}
Kershaw	13,769	13,919	14,042	14,336	14,765	(2,953)	[709]	{354}	15,260	(3,052)	[732]	{366}	15,837	(3,167)	[760]	{380}
Lexington	61,384	62,027	62,667	63,788	65,814	(13,163)	[3,159]	{1,580}	68,182	(13,636)	[3,273]	{1,636}	71,005	(14,201)	[3,408]	{1,704}
Richland	79,763	80,959	81,927	83,761	87,386	(17,477)	[4,195]	{2,097}	91,686	(18,337)	[4,401]	{2,200}	96,806	(19,361)	[4,647]	{2,323}
Spartanburg	67,225	67,639	67,989	68,878	70,115	(14,023)	[3,366]	{1,683}	71,553	(14,311)	[3,435]	{1,717}	73,215	(14,643)	[3,514]	{1,757}
York	53,158	53,661	54,011	54,802	56,020	(11,204)	[2,689]	{1,344}	57,408	(11,482)	[2,756]	{1,378}	59,015	(11,803)	[2,833]	{1,416}

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.