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

Date: 1/14/22

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 1/14/22 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.

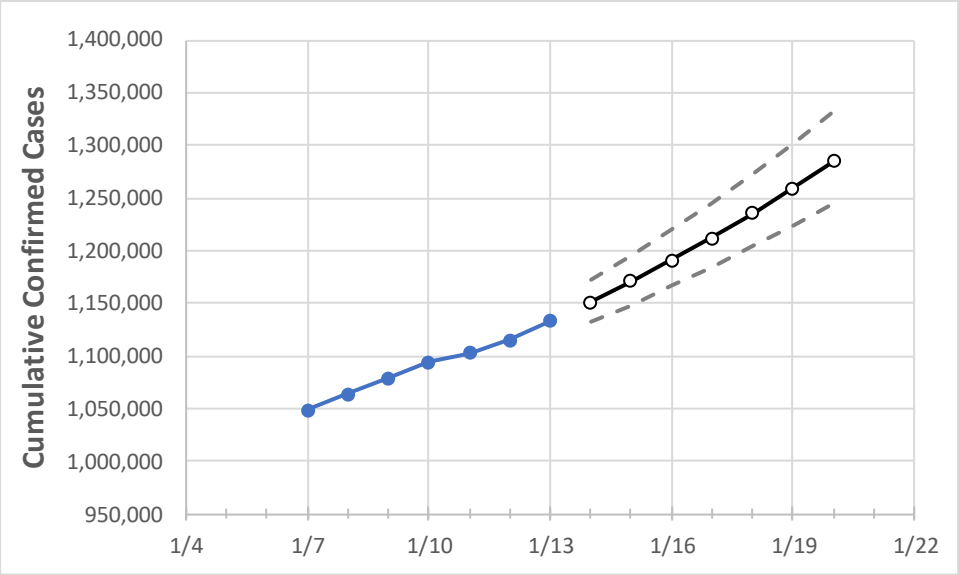
IEM's Modeling Lead

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
South Carolina	1,094,226	1,102,603	1,114,781	1,132,825	1,151,014	1,170,531	1,190,821	1,212,178	1,235,136	1,259,548	1,284,881

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Beaufort	32,121	32,497	32,749	33,168	33,699	34,285	34,879	35,541	36,239	36,990	37,788
Charleston	83,608	84,332	85,515	86,847	88,471	90,240	92,035	93,950	95,994	98,131	100,409
Greenville	128,738	129,795	131,064	132,731	134,756	136,827	139,010	141,318	143,727	146,251	148,917
Kershaw	15,107	15,257	15,429	15,761	16,031	16,308	16,603	16,907	17,239	17,579	17,936
Lexington	68,116	68,833	69,550	70,861	72,176	73,563	74,987	76,493	78,100	79,818	81,576
Richland	89,803	90,724	91,971	93,834	95,708	97,668	99,726	101,857	104,134	106,471	108,910
Spartanburg	72,040	72,378	73,622	74,877	76,047	77,284	78,620	80,046	81,564	83,226	84,915
York	57,109	57,388	57,922	59,544	60,436	61,362	62,328	63,339	64,437	65,617	66,860

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:											
	1/10	1/11	1/12	1/13	1/15				1/17				1/19			
Beaufort	32,121	32,497	32,749	33,168	34,285	(6,857)	[1,646]	{823}	35,541	(7,108)	[1,706]	{853}	36,990	(7,398)	[1,776]	{888}
Charleston	83,608	84,332	85,515	86,847	90,240	(18,048)	[4,332]	{2,166}	93,950	(18,790)	[4,510]	{2,255}	98,131	(19,626)	[4,710]	{2,355}
Greenville	128,738	129,795	131,064	132,731	136,827	(27,365)	[6,568]	{3,284}	141,318	(28,264)	[6,783]	{3,392}	146,251	(29,250)	[7,020]	{3,510}
Kershaw	15,107	15,257	15,429	15,761	16,308	(3,262)	[783]	{391}	16,907	(3,381)	[812]	{406}	17,579	(3,516)	[844]	{422}
Lexington	68,116	68,833	69,550	70,861	73,563	(14,713)	[3,531]	{1,766}	76,493	(15,299)	[3,672]	{1,836}	79,818	(15,964)	[3,831]	{1,916}
Richland	89,803	90,724	91,971	93,834	97,668	(19,534)	[4,688]	{2,344}	101,857	(20,371)	[4,889]	{2,445}	106,471	(21,294)	[5,111]	{2,555}
Spartanburg	72,040	72,378	73,622	74,877	77,284	(15,457)	[3,710]	{1,855}	80,046	(16,009)	[3,842]	{1,921}	83,226	(16,645)	[3,995]	{1,997}
York	57,109	57,388	57,922	59,544	61,362	(12,272)	[2,945]	{1,473}	63,339	(12,668)	[3,040]	{1,520}	65,617	(13,123)	[3,150]	{1,575}

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.