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

Date: 10/11/21

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 10/11/21 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.

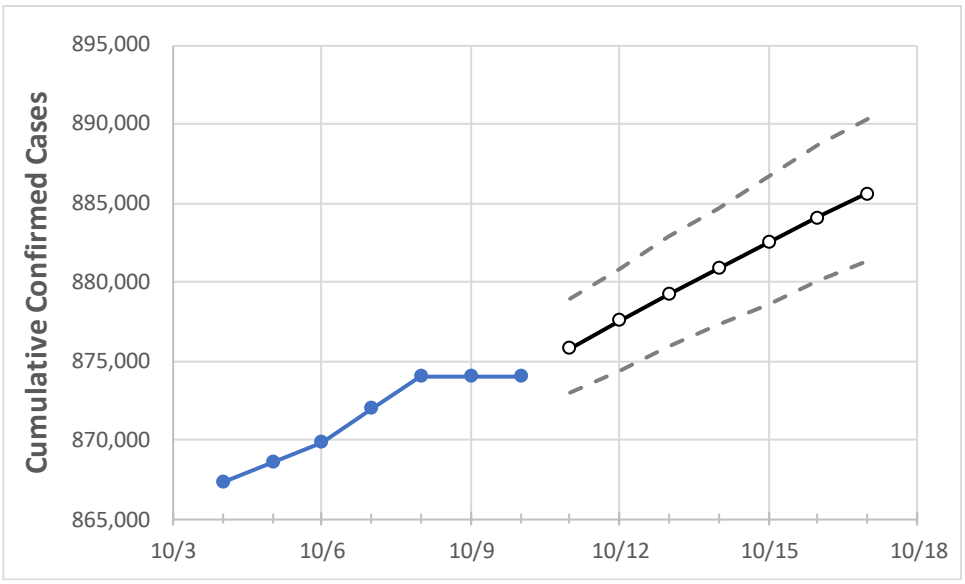
IEM's Modeling Lead

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
South Carolina	872,011	874,013	874,013	874,013	875,832	877,581	879,212	880,870	882,524	884,102	885,608

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Beaufort	26,649	26,703	26,703	26,703	26,741	26,777	26,812	26,848	26,882	26,916	26,948
Charleston	63,790	63,873	63,873	63,873	63,968	64,063	64,151	64,244	64,330	64,415	64,501
Greenville	101,763	102,003	102,003	102,003	102,207	102,413	102,601	102,796	102,983	103,173	103,354
Kershaw	11,623	11,654	11,654	11,654	11,684	11,713	11,740	11,768	11,797	11,823	11,850
Lexington	52,990	53,105	53,105	53,105	53,192	53,280	53,363	53,447	53,527	53,603	53,679
Richland	67,328	67,435	67,435	67,435	67,541	67,644	67,745	67,843	67,942	68,036	68,129
Spartanburg	60,015	60,139	60,139	60,139	60,295	60,465	60,618	60,780	60,923	61,074	61,218
York	45,459	45,564	45,564	45,564	45,654	45,741	45,826	45,906	45,989	46,069	46,146

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:											
	10/7	10/8	10/9	10/10	10/12				10/14				10/16			
Beaufort	26,649	26,703	26,703	26,703	26,777	(5,355)	[1,285]	{643}	26,848	(5,370)	[1,289]	{644}	26,916	(5,383)	[1,292]	{646}
Charleston	63,790	63,873	63,873	63,873	64,063	(12,813)	[3,075]	{1,538}	64,244	(12,849)	[3,084]	{1,542}	64,415	(12,883)	[3,092]	{1,546}
Greenville	101,763	102,003	102,003	102,003	102,413	(20,483)	[4,916]	{2,458}	102,796	(20,559)	[4,934]	{2,467}	103,173	(20,635)	[4,952]	{2,476}
Kershaw	11,623	11,654	11,654	11,654	11,713	(2,343)	[562]	{281}	11,768	(2,354)	[565]	{282}	11,823	(2,365)	[568]	{284}
Lexington	52,990	53,105	53,105	53,105	53,280	(10,656)	[2,557]	{1,279}	53,447	(10,689)	[2,565]	{1,283}	53,603	(10,721)	[2,573]	{1,286}
Richland	67,328	67,435	67,435	67,435	67,644	(13,529)	[3,247]	{1,623}	67,843	(13,569)	[3,256]	{1,628}	68,036	(13,607)	[3,266]	{1,633}
Spartanburg	60,015	60,139	60,139	60,139	60,465	(12,093)	[2,902]	{1,451}	60,780	(12,156)	[2,917]	{1,459}	61,074	(12,215)	[2,932]	{1,466}
York	45,459	45,564	45,564	45,564	45,741	(9,148)	[2,196]	{1,098}	45,906	(9,181)	[2,203]	{1,102}	46,069	(9,214)	[2,211]	{1,106}

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.