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

Date: 2/23/22

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 2/23/22 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.

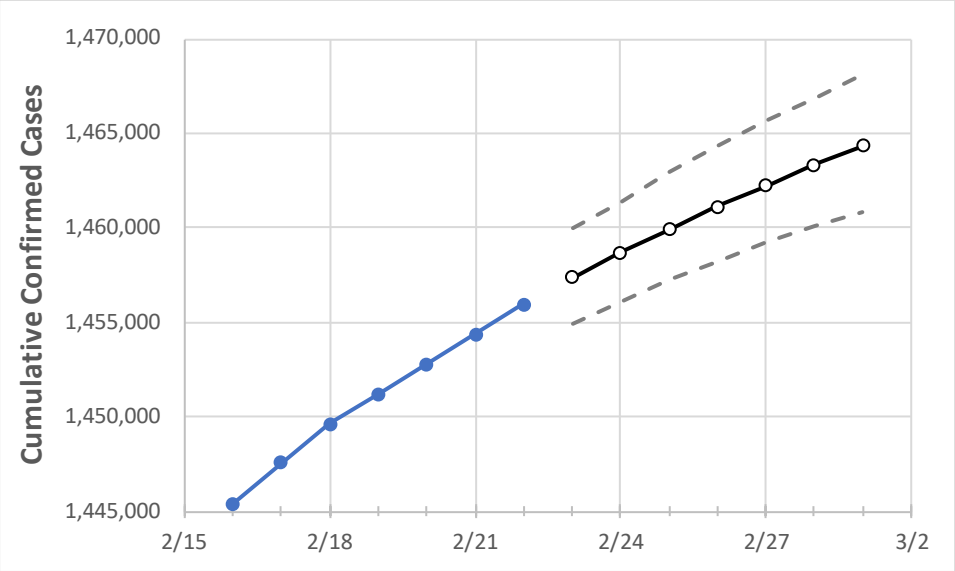
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
South Carolina	1,451,220	1,452,802	1,454,385	1,455,967	1,457,365	1,458,692	1,459,917	1,461,129	1,462,236	1,463,336	1,464,357

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Beaufort	42,427	42,469	42,512	42,554	42,594	42,633	42,667	42,703	42,735	42,767	42,797
Charleston	110,345	110,429	110,512	110,596	110,669	110,738	110,799	110,858	110,917	110,971	111,017
Greenville	170,761	170,850	170,940	171,029	171,115	171,195	171,269	171,337	171,405	171,471	171,524
Kershaw	21,007	21,069	21,131	21,193	21,242	21,289	21,333	21,377	21,421	21,464	21,507
Lexington	94,486	94,586	94,686	94,786	94,881	94,965	95,049	95,128	95,200	95,271	95,336
Richland	119,833	120,267	120,700	121,134	121,353	121,552	121,761	121,947	122,154	122,334	122,510
Spartanburg	93,504	93,572	93,639	93,707	93,776	93,840	93,902	93,961	94,017	94,066	94,118
York	76,555	76,636	76,717	76,798	76,879	76,953	77,025	77,093	77,160	77,219	77,276

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:			
	2/19	2/20	2/21	2/22	2/24	2/26	2/28	
Beaufort	42,427	42,469	42,512	42,554	42,633 (8,527) [2,046] {1,023}	42,703 (8,541) [2,050] {1,025}	42,767 (8,553) [2,053] {1,026}	
Charleston	110,345	110,429	110,512	110,596	110,738 (22,148) [5,315] {2,658}	110,858 (22,172) [5,321] {2,661}	110,971 (22,194) [5,327] {2,663}	
Greenville	170,761	170,850	170,940	171,029	171,195 (34,239) [8,217] {4,109}	171,337 (34,267) [8,224] {4,112}	171,471 (34,294) [8,231] {4,115}	
Kershaw	21,007	21,069	21,131	21,193	21,289 (4,258) [1,022] {511}	21,377 (4,275) [1,026] {513}	21,464 (4,293) [1,030] {515}	
Lexington	94,486	94,586	94,686	94,786	94,965 (18,993) [4,558] {2,279}	95,128 (19,026) [4,566] {2,283}	95,271 (19,054) [4,573] {2,287}	
Richland	119,833	120,267	120,700	121,134	121,552 (24,310) [5,835] {2,917}	121,947 (24,389) [5,853] {2,927}	122,334 (24,467) [5,872] {2,936}	
Spartanburg	93,504	93,572	93,639	93,707	93,840 (18,768) [4,504] {2,252}	93,961 (18,792) [4,510] {2,255}	94,066 (18,813) [4,515] {2,258}	
York	76,555	76,636	76,717	76,798	76,953 (15,391) [3,694] {1,847}	77,093 (15,419) [3,700] {1,850}	77,219 (15,444) [3,707] {1,853}	

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.