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

Date: 2/18/22

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 2/18/22 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.

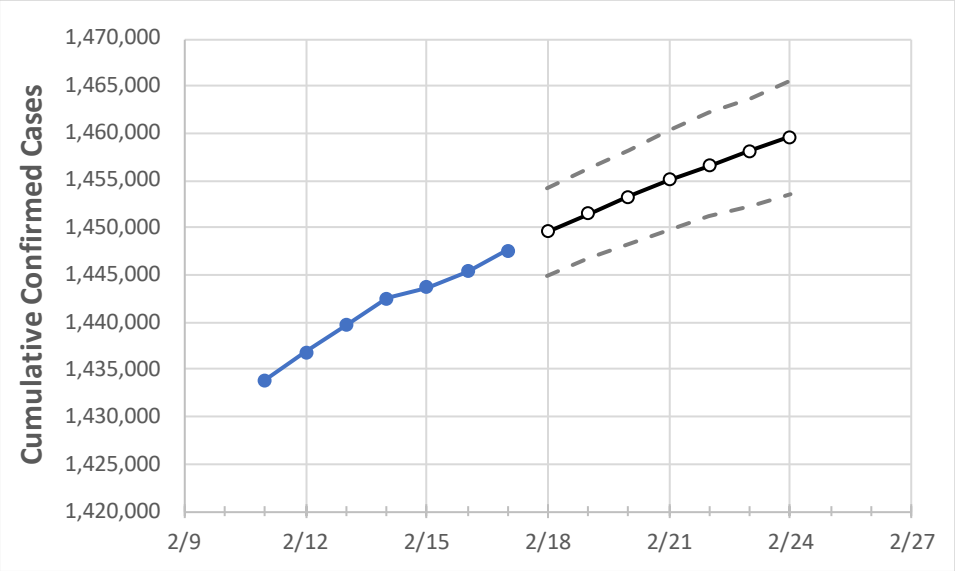
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
South Carolina	1,442,546	1,443,723	1,445,381	1,447,557	1,449,642	1,451,528	1,453,305	1,455,054	1,456,607	1,458,153	1,459,624

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Beaufort	42,162	42,188	42,255	42,317	42,385	42,451	42,511	42,569	42,623	42,679	42,727
Charleston	109,912	109,971	110,047	110,148	110,273	110,393	110,498	110,604	110,700	110,791	110,879
Greenville	170,161	170,273	170,362	170,533	170,690	170,833	170,960	171,090	171,211	171,314	171,426
Kershaw	20,763	20,785	20,848	20,882	20,928	20,972	21,012	21,052	21,090	21,129	21,163
Lexington	93,897	93,977	94,079	94,245	94,389	94,524	94,653	94,774	94,886	94,996	95,093
Richland	118,759	118,849	119,056	119,215	119,401	119,581	119,747	119,913	120,073	120,221	120,355
Spartanburg	93,061	93,109	93,188	93,359	93,483	93,602	93,711	93,813	93,915	94,017	94,102
York	76,026	76,129	76,224	76,309	76,442	76,561	76,681	76,792	76,898	77,002	77,095

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:			
	2/14	2/15	2/16	2/17	2/19	2/21	2/23	
Beaufort	42,162	42,188	42,255	42,317	42,451 (8,490) [2,038] {1,019}	42,569 (8,514) [2,043] {1,022}	42,679 (8,536) [2,049] {1,024}	
Charleston	109,912	109,971	110,047	110,148	110,393 (22,079) [5,299] {2,649}	110,604 (22,121) [5,309] {2,654}	110,791 (22,158) [5,318] {2,659}	
Greenville	170,161	170,273	170,362	170,533	170,833 (34,167) [8,200] {4,100}	171,090 (34,218) [8,212] {4,106}	171,314 (34,263) [8,223] {4,112}	
Kershaw	20,763	20,785	20,848	20,882	20,972 (4,194) [1,007] {503}	21,052 (4,210) [1,011] {505}	21,129 (4,226) [1,014] {507}	
Lexington	93,897	93,977	94,079	94,245	94,524 (18,905) [4,537] {2,269}	94,774 (18,955) [4,549] {2,275}	94,996 (18,999) [4,560] {2,280}	
Richland	118,759	118,849	119,056	119,215	119,581 (23,916) [5,740] {2,870}	119,913 (23,983) [5,756] {2,878}	120,221 (24,044) [5,771] {2,885}	
Spartanburg	93,061	93,109	93,188	93,359	93,602 (18,720) [4,493] {2,246}	93,813 (18,763) [4,503] {2,252}	94,017 (18,803) [4,513] {2,256}	
York	76,026	76,129	76,224	76,309	76,561 (15,312) [3,675] {1,837}	76,792 (15,358) [3,686] {1,843}	77,002 (15,400) [3,696] {1,848}	

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.