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

Date: 3/2/22

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 3/2/22 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.

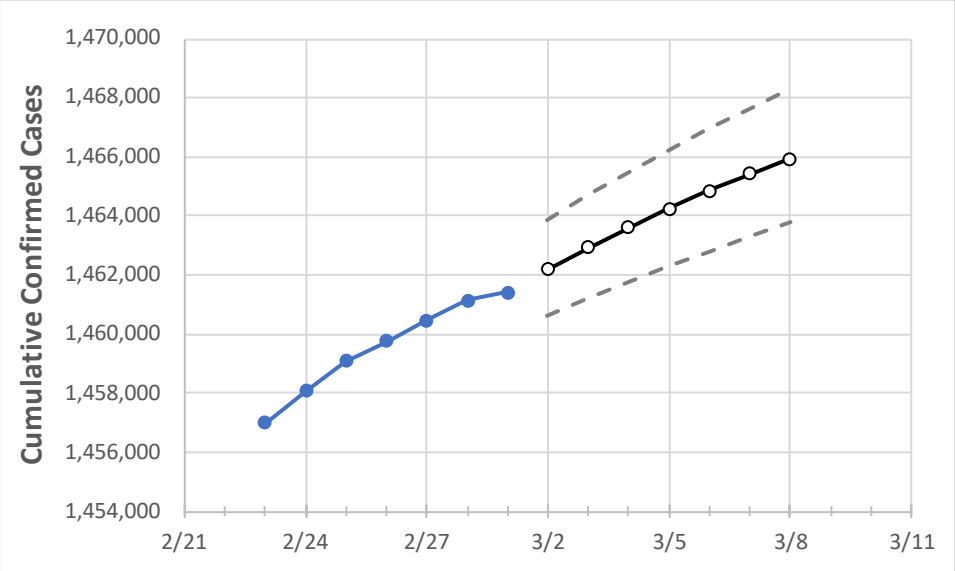
IEM's Modeling Lead

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
South Carolina	1,459,765	1,460,460	1,461,155	1,461,426	1,462,204	1,462,922	1,463,606	1,464,257	1,464,849	1,465,446	1,465,948

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Beaufort	42,708	42,726	42,743	42,751	42,776	42,800	42,822	42,843	42,864	42,882	42,902
Charleston	110,859	110,905	110,950	110,970	111,015	111,057	111,095	111,131	111,167	111,199	111,232
Greenville	171,210	171,260	171,310	171,327	171,369	171,413	171,449	171,484	171,517	171,549	171,579
Kershaw	21,288	21,303	21,318	21,319	21,347	21,374	21,399	21,424	21,447	21,471	21,494
Lexington	95,025	95,065	95,104	95,130	95,179	95,225	95,269	95,310	95,349	95,387	95,422
Richland	121,440	121,502	121,563	121,593	121,738	121,871	121,997	122,127	122,241	122,383	122,477
Spartanburg	93,897	93,930	93,964	93,980	94,019	94,054	94,089	94,121	94,152	94,184	94,209
York	77,033	77,079	77,124	77,139	77,185	77,230	77,268	77,306	77,345	77,382	77,413

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:			
	2/26	2/27	2/28	3/1	3/3	3/5	3/7	
Beaufort	42,708	42,726	42,743	42,751	42,800 (8,560) [2,054] {1,027}	42,843 (8,569) [2,056] {1,028}	42,882 (8,576) [2,058] {1,029}	
Charleston	110,859	110,905	110,950	110,970	111,057 (22,211) [5,331] {2,665}	111,131 (22,226) [5,334] {2,667}	111,199 (22,240) [5,338] {2,669}	
Greenville	171,210	171,260	171,310	171,327	171,413 (34,283) [8,228] {4,114}	171,484 (34,297) [8,231] {4,116}	171,549 (34,310) [8,234] {4,117}	
Kershaw	21,288	21,303	21,318	21,319	21,374 (4,275) [1,026] {513}	21,424 (4,285) [1,028] {514}	21,471 (4,294) [1,031] {515}	
Lexington	95,025	95,065	95,104	95,130	95,225 (19,045) [4,571] {2,285}	95,310 (19,062) [4,575] {2,287}	95,387 (19,077) [4,579] {2,289}	
Richland	121,440	121,502	121,563	121,593	121,871 (24,374) [5,850] {2,925}	122,127 (24,425) [5,862] {2,931}	122,383 (24,477) [5,874] {2,937}	
Spartanburg	93,897	93,930	93,964	93,980	94,054 (18,811) [4,515] {2,257}	94,121 (18,824) [4,518] {2,259}	94,184 (18,837) [4,521] {2,260}	
York	77,033	77,079	77,124	77,139	77,230 (15,446) [3,707] {1,854}	77,306 (15,461) [3,711] {1,855}	77,382 (15,476) [3,714] {1,857}	

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.