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

Date: 4/22/21

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 4/22/21 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.

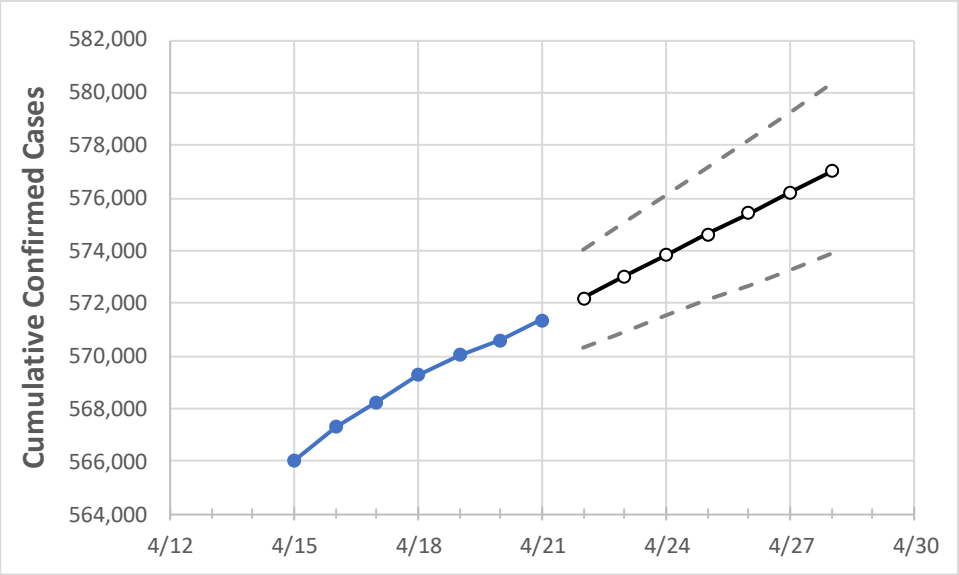
IEM's Modeling Lead

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:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
South Carolina	569,279	570,032	570,606	571,369	572,188	573,015	573,831	574,637	575,426	576,226	577,026

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:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Beaufort	16,534	16,545	16,550	16,561	16,572	16,583	16,594	16,604	16,614	16,624	16,634
Charleston	42,004	42,075	42,123	42,181	42,253	42,324	42,396	42,467	42,538	42,609	42,678
Greenville	72,343	72,458	72,543	72,627	72,727	72,827	72,921	73,014	73,105	73,195	73,284
Kershaw	7,253	7,272	7,279	7,294	7,307	7,321	7,335	7,350	7,364	7,379	7,394
Lexington	32,548	32,591	32,614	32,638	32,686	32,734	32,783	32,830	32,877	32,925	32,973
Richland	45,230	45,287	45,320	45,384	45,456	45,529	45,601	45,673	45,744	45,816	45,888
Spartanburg	40,224	40,270	40,310	40,355	40,398	40,437	40,476	40,514	40,549	40,584	40,617
York	29,827	29,879	29,929	29,991	30,059	30,125	30,194	30,262	30,329	30,399	30,469

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:		
	4/18	4/19	4/20	4/21	4/23	4/25	4/27
Beaufort	16,534	16,545	16,550	16,561	16,583 (3,317) [796] {398}	16,604 (3,321) [797] {399}	16,624 (3,325) [798] {399}
Charleston	42,004	42,075	42,123	42,181	42,324 (8,465) [2,032] {1,016}	42,467 (8,493) [2,038] {1,019}	42,609 (8,522) [2,045] {1,023}
Greenville	72,343	72,458	72,543	72,627	72,827 (14,565) [3,496] {1,748}	73,014 (14,603) [3,505] {1,752}	73,195 (14,639) [3,513] {1,757}
Kershaw	7,253	7,272	7,279	7,294	7,321 (1,464) [351] {176}	7,350 (1,470) [353] {176}	7,379 (1,476) [354] {177}
Lexington	32,548	32,591	32,614	32,638	32,734 (6,547) [1,571] {786}	32,830 (6,566) [1,576] {788}	32,925 (6,585) [1,580] {790}
Richland	45,230	45,287	45,320	45,384	45,529 (9,106) [2,185] {1,093}	45,673 (9,135) [2,192] {1,096}	45,816 (9,163) [2,199] {1,100}
Spartanburg	40,224	40,270	40,310	40,355	40,437 (8,087) [1,941] {970}	40,514 (8,103) [1,945] {972}	40,584 (8,117) [1,948] {974}
York	29,827	29,879	29,929	29,991	30,125 (6,025) [1,446] {723}	30,262 (6,052) [1,453] {726}	30,399 (6,080) [1,459] {730}

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.