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

Date: 4/26/21

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 4/26/21 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.

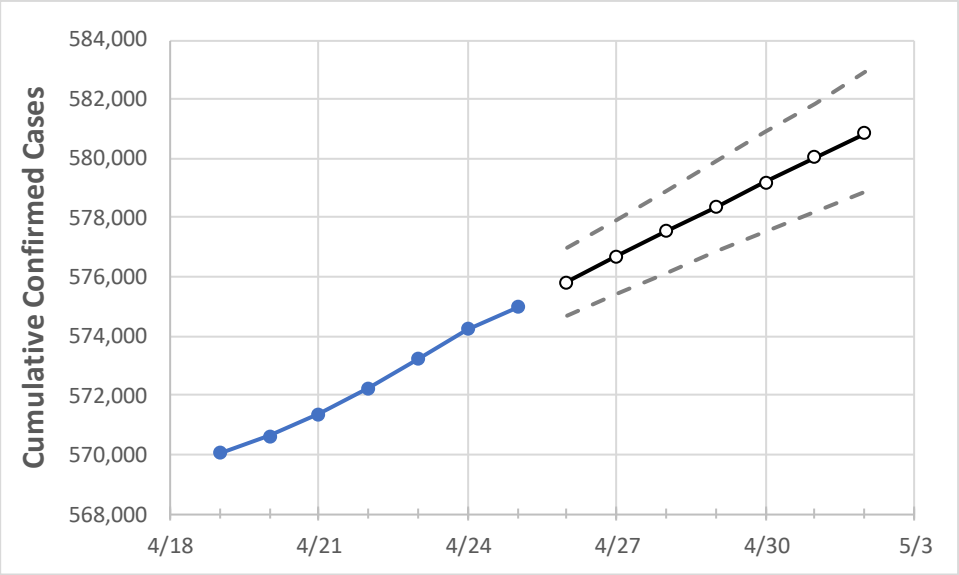
IEM's Modeling Lead

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:						
	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2
South Carolina	572,248	573,225	574,226	574,985	575,826	576,682	577,529	578,364	579,198	580,036	580,852

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:						
	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2
Beaufort	16,574	16,597	16,604	16,611	16,621	16,631	16,640	16,649	16,659	16,668	16,676
Charleston	42,233	42,294	42,348	42,432	42,496	42,561	42,625	42,688	42,750	42,813	42,876
Greenville	72,738	72,859	72,976	73,064	73,163	73,260	73,353	73,445	73,536	73,625	73,712
Kershaw	7,297	7,321	7,342	7,367	7,384	7,401	7,419	7,437	7,457	7,476	7,496
Lexington	32,696	32,753	32,798	32,840	32,889	32,935	32,982	33,030	33,078	33,125	33,171
Richland	45,429	45,512	45,634	45,683	45,758	45,832	45,907	45,983	46,059	46,134	46,209
Spartanburg	40,395	40,450	40,518	40,563	40,605	40,646	40,687	40,725	40,765	40,802	40,837
York	30,035	30,101	30,273	30,329	30,407	30,486	30,565	30,646	30,729	30,812	30,895

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:		
	4/22	4/23	4/24	4/25	4/27	4/29	5/1
Beaufort	16,574	16,597	16,604	16,611	16,631 (3,326) [798] {399}	16,649 (3,330) [799] {400}	16,668 (3,334) [800] {400}
Charleston	42,233	42,294	42,348	42,432	42,561 (8,512) [2,043] {1,021}	42,688 (8,538) [2,049] {1,025}	42,813 (8,563) [2,055] {1,028}
Greenville	72,738	72,859	72,976	73,064	73,260 (14,652) [3,516] {1,758}	73,445 (14,689) [3,525] {1,763}	73,625 (14,725) [3,534] {1,767}
Kershaw	7,297	7,321	7,342	7,367	7,401 (1,480) [355] {178}	7,437 (1,487) [357] {178}	7,476 (1,495) [359] {179}
Lexington	32,696	32,753	32,798	32,840	32,935 (6,587) [1,581] {790}	33,030 (6,606) [1,585] {793}	33,125 (6,625) [1,590] {795}
Richland	45,429	45,512	45,634	45,683	45,832 (9,166) [2,200] {1,100}	45,983 (9,197) [2,207] {1,104}	46,134 (9,227) [2,214] {1,107}
Spartanburg	40,395	40,450	40,518	40,563	40,646 (8,129) [1,951] {975}	40,725 (8,145) [1,955] {977}	40,802 (8,160) [1,959] {979}
York	30,035	30,101	30,273	30,329	30,486 (6,097) [1,463] {732}	30,646 (6,129) [1,471] {735}	30,812 (6,162) [1,479] {739}

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.