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

Date: 4/27/21

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 4/27/21 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.

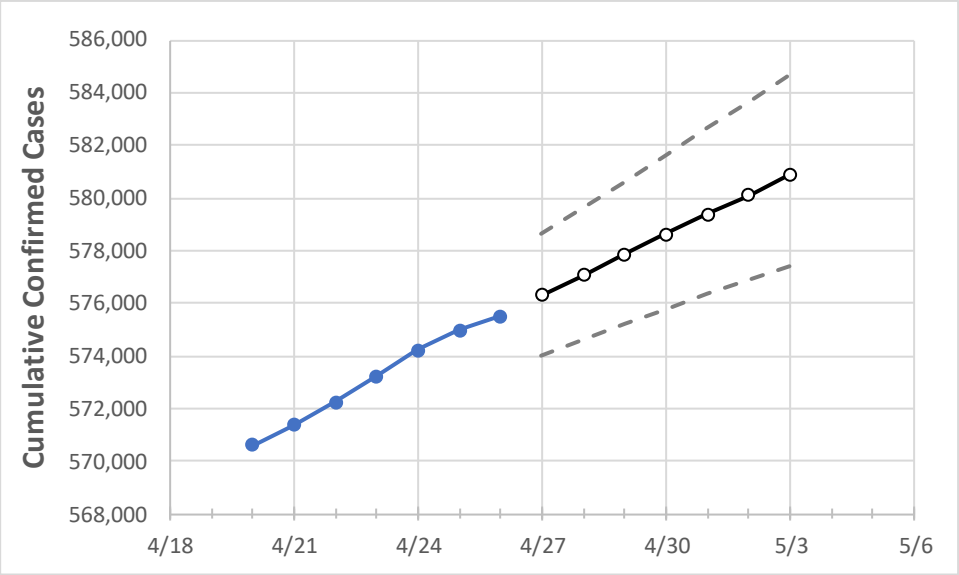
IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
South Carolina	573,225	574,226	574,985	575,515	576,323	577,083	577,855	578,622	579,381	580,118	580,885

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Beaufort	16,597	16,604	16,611	16,623	16,633	16,644	16,653	16,663	16,673	16,682	16,691
Charleston	42,294	42,348	42,432	42,473	42,534	42,597	42,659	42,720	42,781	42,842	42,902
Greenville	72,859	72,976	73,064	73,140	73,233	73,324	73,413	73,501	73,588	73,672	73,754
Kershaw	7,321	7,342	7,367	7,372	7,388	7,404	7,420	7,436	7,454	7,471	7,489
Lexington	32,753	32,798	32,840	32,864	32,908	32,951	32,994	33,037	33,079	33,120	33,162
Richland	45,512	45,634	45,683	45,723	45,791	45,859	45,925	45,993	46,059	46,124	46,190
Spartanburg	40,450	40,518	40,563	40,611	40,653	40,696	40,738	40,779	40,817	40,855	40,892
York	30,101	30,273	30,329	30,373	30,447	30,521	30,595	30,672	30,748	30,824	30,901

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:		
	4/23	4/24	4/25	4/26	4/28	4/30	5/2
Beaufort	16,597	16,604	16,611	16,623	16,644 (3,329) [799] {399}	16,663 (3,333) [800] {400}	16,682 (3,336) [801] {400}
Charleston	42,294	42,348	42,432	42,473	42,597 (8,519) [2,045] {1,022}	42,720 (8,544) [2,051] {1,025}	42,842 (8,568) [2,056] {1,028}
Greenville	72,859	72,976	73,064	73,140	73,324 (14,665) [3,520] {1,760}	73,501 (14,700) [3,528] {1,764}	73,672 (14,734) [3,536] {1,768}
Kershaw	7,321	7,342	7,367	7,372	7,404 (1,481) [355] {178}	7,436 (1,487) [357] {178}	7,471 (1,494) [359] {179}
Lexington	32,753	32,798	32,840	32,864	32,951 (6,590) [1,582] {791}	33,037 (6,607) [1,586] {793}	33,120 (6,624) [1,590] {795}
Richland	45,512	45,634	45,683	45,723	45,859 (9,172) [2,201] {1,101}	45,993 (9,199) [2,208] {1,104}	46,124 (9,225) [2,214] {1,107}
Spartanburg	40,450	40,518	40,563	40,611	40,696 (8,139) [1,953] {977}	40,779 (8,156) [1,957] {979}	40,855 (8,171) [1,961] {981}
York	30,101	30,273	30,329	30,373	30,521 (6,104) [1,465] {732}	30,672 (6,134) [1,472] {736}	30,824 (6,165) [1,480] {740}

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.