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

Date: 5/10/21

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 5/10/21 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.

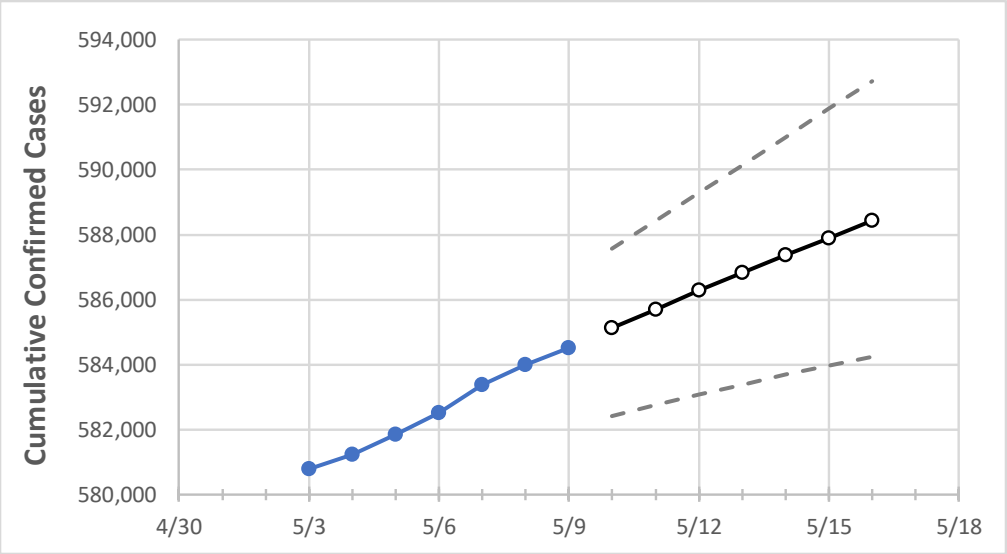
IEM's Modeling Lead

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:						
	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16
South Carolina	582,506	583,373	583,996	584,517	585,124	585,703	586,274	586,832	587,364	587,883	588,420

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:						
	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16
Beaufort	16,724	16,742	16,761	16,773	16,785	16,797	16,808	16,820	16,832	16,844	16,857
Charleston	42,994	43,035	43,072	43,111	43,151	43,191	43,229	43,266	43,303	43,337	43,371
Greenville	74,003	74,106	74,160	74,253	74,329	74,403	74,476	74,549	74,621	74,690	74,761
Kershaw	7,452	7,461	7,468	7,471	7,477	7,482	7,487	7,492	7,497	7,502	7,506
Lexington	33,168	33,192	33,226	33,254	33,279	33,303	33,327	33,350	33,373	33,396	33,419
Richland	46,359	46,428	46,473	46,518	46,577	46,635	46,693	46,748	46,807	46,861	46,916
Spartanburg	41,031	41,162	41,214	41,249	41,299	41,349	41,400	41,451	41,503	41,554	41,606
York	30,980	31,039	31,099	31,141	31,198	31,254	31,310	31,366	31,421	31,477	31,533

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:		
	5/6	5/7	5/8	5/9	5/11	5/13	5/15
Beaufort	16,724	16,742	16,761	16,773	16,797 (3,359) [806] {403}	16,820 (3,364) [807] {404}	16,844 (3,369) [809] {404}
Charleston	42,994	43,035	43,072	43,111	43,191 (8,638) [2,073] {1,037}	43,266 (8,653) [2,077] {1,038}	43,337 (8,667) [2,080] {1,040}
Greenville	74,003	74,106	74,160	74,253	74,403 (14,881) [3,571] {1,786}	74,549 (14,910) [3,578] {1,789}	74,690 (14,938) [3,585] {1,793}
Kershaw	7,452	7,461	7,468	7,471	7,482 (1,496) [359] {180}	7,492 (1,498) [360] {180}	7,502 (1,500) [360] {180}
Lexington	33,168	33,192	33,226	33,254	33,303 (6,661) [1,599] {799}	33,350 (6,670) [1,601] {800}	33,396 (6,679) [1,603] {801}
Richland	46,359	46,428	46,473	46,518	46,635 (9,327) [2,238] {1,119}	46,748 (9,350) [2,244] {1,122}	46,861 (9,372) [2,249] {1,125}
Spartanburg	41,031	41,162	41,214	41,249	41,349 (8,270) [1,985] {992}	41,451 (8,290) [1,990] {995}	41,554 (8,311) [1,995] {997}
York	30,980	31,039	31,099	31,141	31,254 (6,251) [1,500] {750}	31,366 (6,273) [1,506] {753}	31,477 (6,295) [1,511] {755}

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.