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

Date: 4/9/21

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 4/9/21 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.

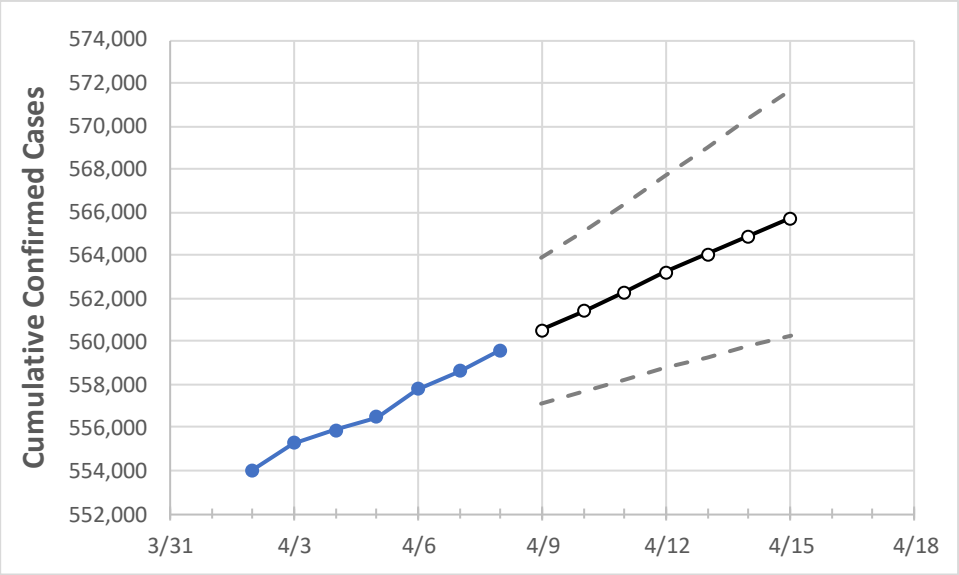
IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
South Carolina	556,469	557,803	558,631	559,597	560,517	561,401	562,306	563,212	564,059	564,898	565,739

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Beaufort	16,330	16,360	16,369	16,385	16,398	16,411	16,423	16,435	16,447	16,458	16,469
Charleston	40,971	41,076	41,134	41,231	41,303	41,371	41,440	41,506	41,573	41,641	41,706
Greenville	70,326	70,626	70,887	71,012	71,190	71,377	71,558	71,735	71,911	72,085	72,257
Kershaw	7,096	7,117	7,127	7,136	7,145	7,155	7,164	7,173	7,183	7,192	7,201
Lexington	31,815	31,884	31,914	31,985	32,029	32,072	32,114	32,157	32,198	32,237	32,279
Richland	44,200	44,271	44,323	44,409	44,471	44,533	44,593	44,652	44,710	44,767	44,824
Spartanburg	39,399	39,503	39,539	39,590	39,695	39,797	39,900	40,007	40,106	40,210	40,314
York	28,924	29,018	29,065	29,127	29,189	29,253	29,319	29,383	29,449	29,514	29,581

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:		
	4/5	4/6	4/7	4/8	4/10	4/12	4/14
Beaufort	16,330	16,360	16,369	16,385	16,411 (3,282) [788] {394}	16,435 (3,287) [789] {394}	16,458 (3,292) [790] {395}
Charleston	40,971	41,076	41,134	41,231	41,371 (8,274) [1,986] {993}	41,506 (8,301) [1,992] {996}	41,641 (8,328) [1,999] {999}
Greenville	70,326	70,626	70,887	71,012	71,377 (14,275) [3,426] {1,713}	71,735 (14,347) [3,443] {1,722}	72,085 (14,417) [3,460] {1,730}
Kershaw	7,096	7,117	7,127	7,136	7,155 (1,431) [343] {172}	7,173 (1,435) [344] {172}	7,192 (1,438) [345] {173}
Lexington	31,815	31,884	31,914	31,985	32,072 (6,414) [1,539] {770}	32,157 (6,431) [1,544] {772}	32,237 (6,447) [1,547] {774}
Richland	44,200	44,271	44,323	44,409	44,533 (8,907) [2,138] {1,069}	44,652 (8,930) [2,143] {1,072}	44,767 (8,953) [2,149] {1,074}
Spartanburg	39,399	39,503	39,539	39,590	39,797 (7,959) [1,910] {955}	40,007 (8,001) [1,920] {960}	40,210 (8,042) [1,930] {965}
York	28,924	29,018	29,065	29,127	29,253 (5,851) [1,404] {702}	29,383 (5,877) [1,410] {705}	29,514 (5,903) [1,417] {708}

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.