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

Date: 4/8/21

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 4/8/21 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.

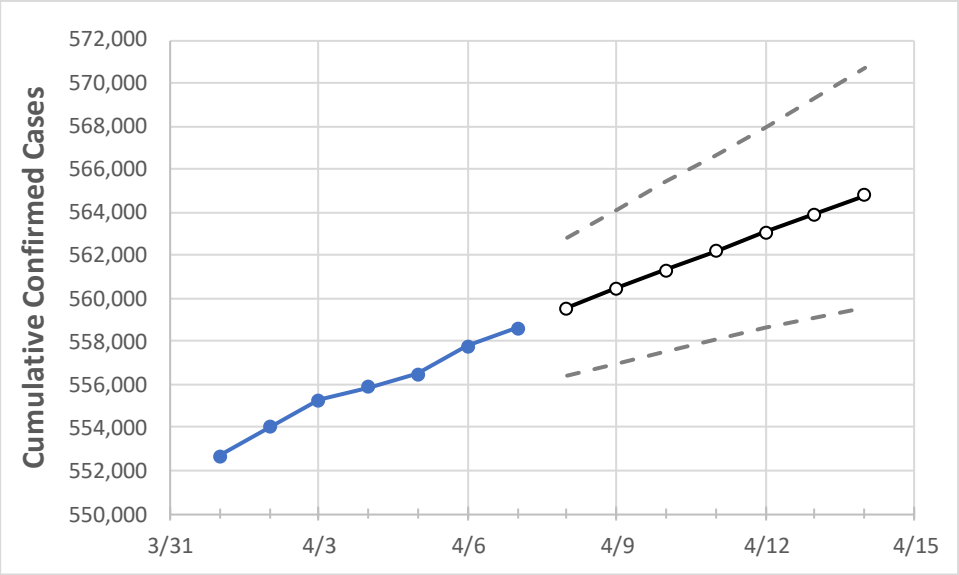
IEM's Modeling Lead

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
South Carolina	555,872	556,469	557,803	558,631	559,556	560,460	561,332	562,208	563,077	563,926	564,812

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Beaufort	16,318	16,330	16,360	16,369	16,383	16,395	16,408	16,420	16,432	16,444	16,455
Charleston	40,931	40,971	41,076	41,134	41,201	41,270	41,335	41,399	41,464	41,527	41,589
Greenville	70,232	70,326	70,626	70,887	71,088	71,293	71,499	71,698	71,896	72,103	72,306
Kershaw	7,092	7,096	7,117	7,127	7,137	7,147	7,157	7,167	7,176	7,186	7,196
Lexington	31,789	31,815	31,884	31,914	31,956	31,998	32,037	32,077	32,115	32,154	32,192
Richland	44,161	44,200	44,271	44,323	44,385	44,444	44,504	44,562	44,620	44,674	44,729
Spartanburg	39,322	39,399	39,503	39,539	39,644	39,750	39,857	39,966	40,069	40,178	40,285
York	28,878	28,924	29,018	29,065	29,128	29,190	29,253	29,315	29,378	29,440	29,502

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:		
	4/4	4/5	4/6	4/7	4/9	4/11	4/13
Beaufort	16,318	16,330	16,360	16,369	16,395 (3,279) [787] {393}	16,420 (3,284) [788] {394}	16,444 (3,289) [789] {395}
Charleston	40,931	40,971	41,076	41,134	41,270 (8,254) [1,981] {990}	41,399 (8,280) [1,987] {994}	41,527 (8,305) [1,993] {997}
Greenville	70,232	70,326	70,626	70,887	71,293 (14,259) [3,422] {1,711}	71,698 (14,340) [3,442] {1,721}	72,103 (14,421) [3,461] {1,730}
Kershaw	7,092	7,096	7,117	7,127	7,147 (1,429) [343] {172}	7,167 (1,433) [344] {172}	7,186 (1,437) [345] {172}
Lexington	31,789	31,815	31,884	31,914	31,998 (6,400) [1,536] {768}	32,077 (6,415) [1,540] {770}	32,154 (6,431) [1,543] {772}
Richland	44,161	44,200	44,271	44,323	44,444 (8,889) [2,133] {1,067}	44,562 (8,912) [2,139] {1,069}	44,674 (8,935) [2,144] {1,072}
Spartanburg	39,322	39,399	39,503	39,539	39,750 (7,950) [1,908] {954}	39,966 (7,993) [1,918] {959}	40,178 (8,036) [1,929] {964}
York	28,878	28,924	29,018	29,065	29,190 (5,838) [1,401] {701}	29,315 (5,863) [1,407] {704}	29,440 (5,888) [1,413] {707}

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.