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

Date: 4/5/21

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 4/5/21 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.

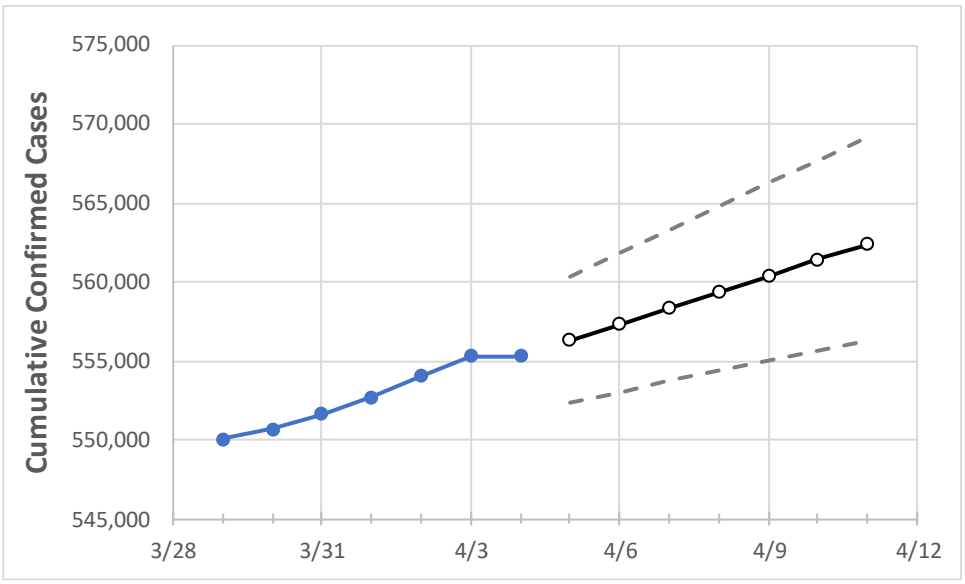
IEM's Modeling Lead

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
South Carolina	552,681	554,031	555,274	555,274	556,287	557,321	558,326	559,348	560,354	561,414	562,405

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Beaufort	16,262	16,289	16,306	16,306	16,323	16,338	16,354	16,369	16,385	16,400	16,414
Charleston	40,707	40,800	40,891	40,891	40,965	41,038	41,111	41,187	41,261	41,332	41,405
Greenville	69,620	69,858	70,138	70,138	70,355	70,582	70,811	71,040	71,277	71,507	71,739
Kershaw	7,067	7,079	7,087	7,087	7,097	7,106	7,116	7,125	7,134	7,144	7,153
Lexington	31,632	31,701	31,763	31,763	31,813	31,864	31,915	31,966	32,017	32,068	32,120
Richland	43,954	44,031	44,122	44,122	44,197	44,272	44,347	44,422	44,498	44,576	44,651
Spartanburg	38,916	39,101	39,244	39,244	39,368	39,498	39,630	39,762	39,897	40,035	40,176
York	28,694	28,765	28,832	28,832	28,892	28,953	29,013	29,075	29,135	29,195	29,255

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:		
	4/1	4/2	4/3	4/4	4/6	4/8	4/10
Beaufort	16,262	16,289	16,306	16,306	16,338 (3,268) [784] {392}	16,369 (3,274) [786] {393}	16,400 (3,280) [787] {394}
Charleston	40,707	40,800	40,891	40,891	41,038 (8,208) [1,970] {985}	41,187 (8,237) [1,977] {988}	41,332 (8,266) [1,984] {992}
Greenville	69,620	69,858	70,138	70,138	70,582 (14,116) [3,388] {1,694}	71,040 (14,208) [3,410] {1,705}	71,507 (14,301) [3,432] {1,716}
Kershaw	7,067	7,079	7,087	7,087	7,106 (1,421) [341] {171}	7,125 (1,425) [342] {171}	7,144 (1,429) [343] {171}
Lexington	31,632	31,701	31,763	31,763	31,864 (6,373) [1,529] {765}	31,966 (6,393) [1,534] {767}	32,068 (6,414) [1,539] {770}
Richland	43,954	44,031	44,122	44,122	44,272 (8,854) [2,125] {1,063}	44,422 (8,884) [2,132] {1,066}	44,576 (8,915) [2,140] {1,070}
Spartanburg	38,916	39,101	39,244	39,244	39,498 (7,900) [1,896] {948}	39,762 (7,952) [1,909] {954}	40,035 (8,007) [1,922] {961}
York	28,694	28,765	28,832	28,832	28,953 (5,791) [1,390] {695}	29,075 (5,815) [1,396] {698}	29,195 (5,839) [1,401] {701}

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.