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

Date: 3/26/21

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 3/26/21 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.

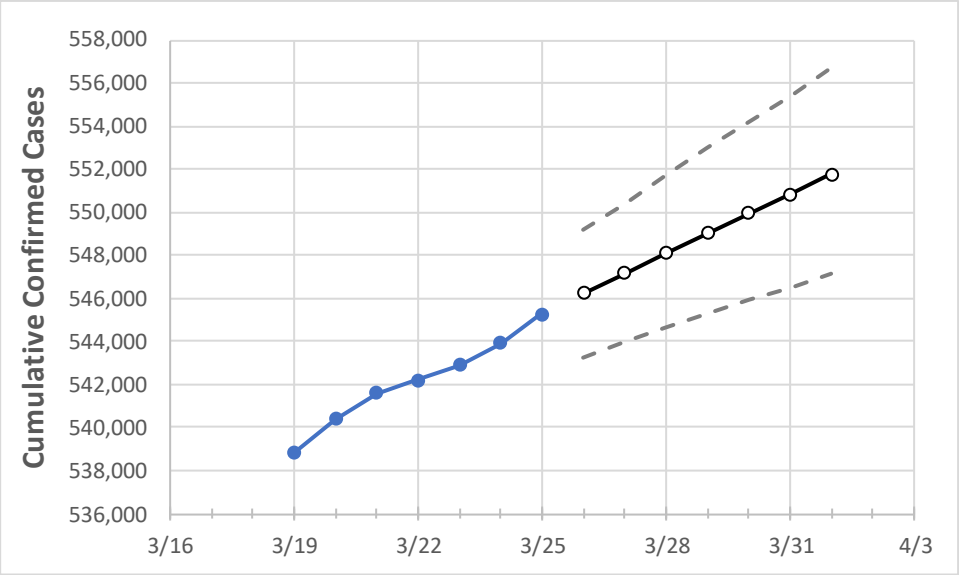
IEM's Modeling Lead

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
South Carolina	542,203	542,912	543,925	545,254	546,231	547,189	548,120	549,041	549,948	550,844	551,770

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Beaufort	16,074	16,092	16,119	16,139	16,158	16,176	16,194	16,212	16,228	16,245	16,261
Charleston	39,983	40,025	40,088	40,172	40,248	40,323	40,398	40,474	40,546	40,619	40,690
Greenville	67,577	67,692	67,919	68,177	68,344	68,513	68,683	68,853	69,025	69,199	69,367
Kershaw	6,966	6,972	6,980	6,989	6,998	7,008	7,017	7,026	7,035	7,044	7,053
Lexington	31,123	31,159	31,201	31,282	31,329	31,375	31,420	31,463	31,506	31,547	31,589
Richland	43,213	43,263	43,317	43,394	43,462	43,529	43,594	43,658	43,721	43,784	43,845
Spartanburg	37,840	37,898	37,992	38,092	38,165	38,238	38,311	38,380	38,446	38,516	38,579
York	28,106	28,163	28,212	28,282	28,337	28,392	28,445	28,496	28,546	28,595	28,643

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Beaufort	16,074	16,092	16,119	16,139	16,176 (3,235) [776] {388}	16,212 (3,242) [778] {389}	16,245 (3,249) [780] {390}
Charleston	39,983	40,025	40,088	40,172	40,323 (8,065) [1,936] {968}	40,474 (8,095) [1,943] {971}	40,619 (8,124) [1,950] {975}
Greenville	67,577	67,692	67,919	68,177	68,513 (13,703) [3,289] {1,644}	68,853 (13,771) [3,305] {1,652}	69,199 (13,840) [3,322] {1,661}
Kershaw	6,966	6,972	6,980	6,989	7,008 (1,402) [336] {168}	7,026 (1,405) [337] {169}	7,044 (1,409) [338] {169}
Lexington	31,123	31,159	31,201	31,282	31,375 (6,275) [1,506] {753}	31,463 (6,293) [1,510] {755}	31,547 (6,309) [1,514] {757}
Richland	43,213	43,263	43,317	43,394	43,529 (8,706) [2,089] {1,045}	43,658 (8,732) [2,096] {1,048}	43,784 (8,757) [2,102] {1,051}
Spartanburg	37,840	37,898	37,992	38,092	38,238 (7,648) [1,835] {918}	38,380 (7,676) [1,842] {921}	38,516 (7,703) [1,849] {924}
York	28,106	28,163	28,212	28,282	28,392 (5,678) [1,363] {681}	28,496 (5,699) [1,368] {684}	28,595 (5,719) [1,373] {686}

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.