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

Date: 3/25/21

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 3/25/21 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.

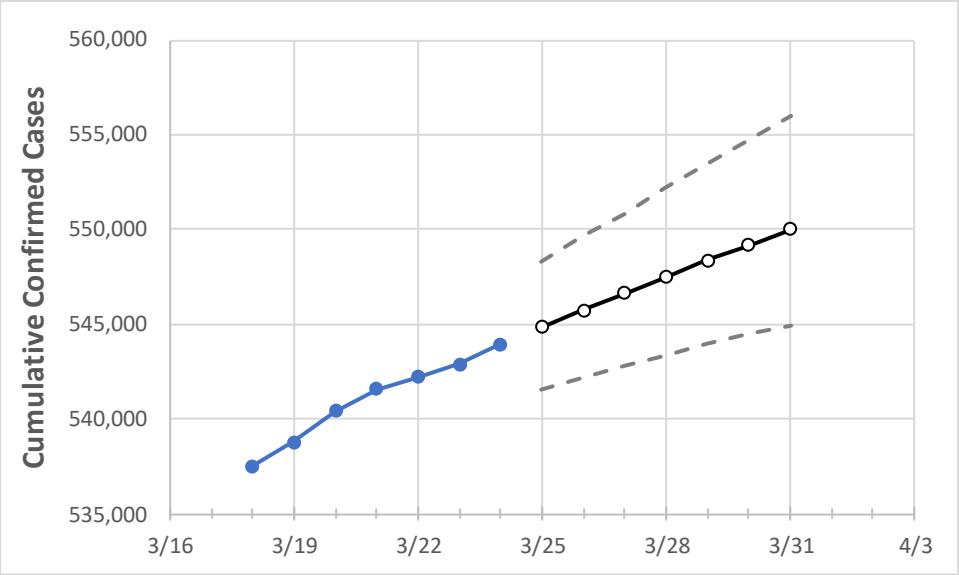
IEM's Modeling Lead

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
South Carolina	541,582	542,203	542,912	543,925	544,860	545,769	546,646	547,498	548,367	549,194	550,038

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Beaufort	16,060	16,074	16,092	16,119	16,139	16,159	16,177	16,195	16,213	16,231	16,248
Charleston	39,929	39,983	40,025	40,088	40,162	40,236	40,309	40,382	40,453	40,526	40,597
Greenville	67,481	67,577	67,692	67,919	68,068	68,222	68,372	68,522	68,676	68,825	68,973
Kershaw	6,948	6,966	6,972	6,980	6,990	6,999	7,008	7,018	7,027	7,035	7,044
Lexington	31,082	31,123	31,159	31,201	31,244	31,286	31,326	31,367	31,406	31,444	31,481
Richland	43,163	43,213	43,263	43,317	43,386	43,456	43,521	43,589	43,652	43,715	43,779
Spartanburg	37,796	37,840	37,898	37,992	38,065	38,136	38,209	38,279	38,348	38,415	38,482
York	28,061	28,106	28,163	28,212	28,265	28,318	28,370	28,422	28,471	28,519	28,566

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:		
	3/21	3/22	3/23	3/24	3/26	3/28	3/30
Beaufort	16,060	16,074	16,092	16,119	16,159 (3,232) [776] {388}	16,195 (3,239) [777] {389}	16,231 (3,246) [779] {390}
Charleston	39,929	39,983	40,025	40,088	40,236 (8,047) [1,931] {966}	40,382 (8,076) [1,938] {969}	40,526 (8,105) [1,945] {973}
Greenville	67,481	67,577	67,692	67,919	68,222 (13,644) [3,275] {1,637}	68,522 (13,704) [3,289] {1,645}	68,825 (13,765) [3,304] {1,652}
Kershaw	6,948	6,966	6,972	6,980	6,999 (1,400) [336] {168}	7,018 (1,404) [337] {168}	7,035 (1,407) [338] {169}
Lexington	31,082	31,123	31,159	31,201	31,286 (6,257) [1,502] {751}	31,367 (6,273) [1,506] {753}	31,444 (6,289) [1,509] {755}
Richland	43,163	43,213	43,263	43,317	43,456 (8,691) [2,086] {1,043}	43,589 (8,718) [2,092] {1,046}	43,715 (8,743) [2,098] {1,049}
Spartanburg	37,796	37,840	37,898	37,992	38,136 (7,627) [1,831] {915}	38,279 (7,656) [1,837] {919}	38,415 (7,683) [1,844] {922}
York	28,061	28,106	28,163	28,212	28,318 (5,664) [1,359] {680}	28,422 (5,684) [1,364] {682}	28,519 (5,704) [1,369] {684}

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.