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

Date: 3/30/21

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 3/30/21 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.

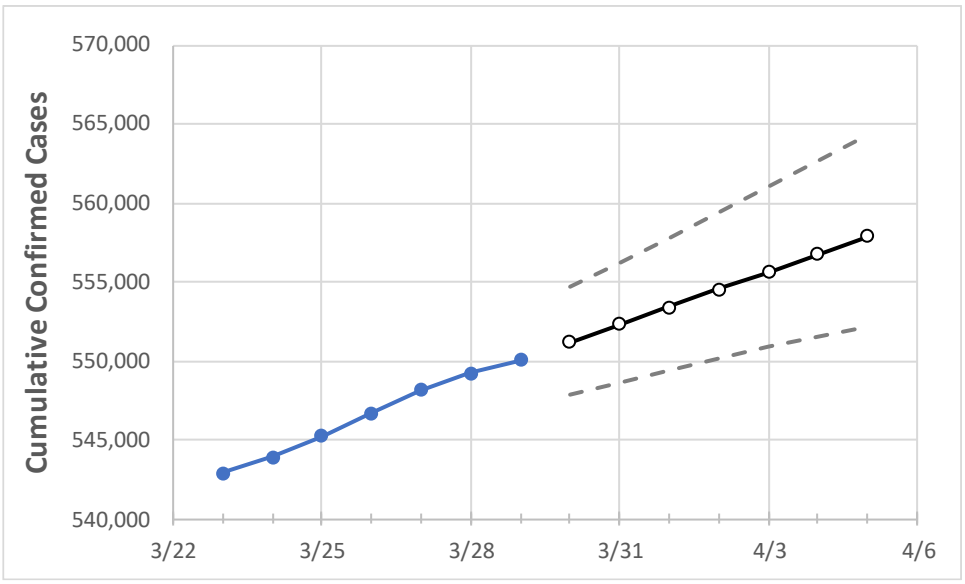
IEM's Modeling Lead

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
South Carolina	546,670	548,114	549,199	550,068	551,191	552,298	553,423	554,540	555,636	556,749	557,879

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Beaufort	16,163	16,194	16,214	16,226	16,247	16,267	16,287	16,307	16,328	16,347	16,366
Charleston	40,259	40,370	40,436	40,504	40,585	40,664	40,743	40,823	40,901	40,978	41,056
Greenville	68,520	68,760	68,968	69,112	69,331	69,551	69,777	70,008	70,237	70,478	70,718
Kershaw	7,005	7,013	7,029	7,038	7,049	7,060	7,070	7,080	7,091	7,102	7,112
Lexington	31,345	31,422	31,479	31,515	31,572	31,631	31,689	31,748	31,805	31,862	31,920
Richland	43,492	43,598	43,687	43,745	43,819	43,894	43,969	44,042	44,115	44,188	44,259
Spartanburg	38,216	38,394	38,533	38,647	38,766	38,887	39,012	39,139	39,272	39,408	39,544
York	28,331	28,408	28,450	28,509	28,563	28,616	28,671	28,725	28,777	28,829	28,880

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:		
	3/26	3/27	3/28	3/29	3/31	4/2	4/4
Beaufort	16,163	16,194	16,214	16,226	16,267 (3,253) [781] {390}	16,307 (3,261) [783] {391}	16,347 (3,269) [785] {392}
Charleston	40,259	40,370	40,436	40,504	40,664 (8,133) [1,952] {976}	40,823 (8,165) [1,960] {980}	40,978 (8,196) [1,967] {983}
Greenville	68,520	68,760	68,968	69,112	69,551 (13,910) [3,338] {1,669}	70,008 (14,002) [3,360] {1,680}	70,478 (14,096) [3,383] {1,691}
Kershaw	7,005	7,013	7,029	7,038	7,060 (1,412) [339] {169}	7,080 (1,416) [340] {170}	7,102 (1,420) [341] {170}
Lexington	31,345	31,422	31,479	31,515	31,631 (6,326) [1,518] {759}	31,748 (6,350) [1,524] {762}	31,862 (6,372) [1,529] {765}
Richland	43,492	43,598	43,687	43,745	43,894 (8,779) [2,107] {1,053}	44,042 (8,808) [2,114] {1,057}	44,188 (8,838) [2,121] {1,061}
Spartanburg	38,216	38,394	38,533	38,647	38,887 (7,777) [1,867] {933}	39,139 (7,828) [1,879] {939}	39,408 (7,882) [1,892] {946}
York	28,331	28,408	28,450	28,509	28,616 (5,723) [1,374] {687}	28,725 (5,745) [1,379] {689}	28,829 (5,766) [1,384] {692}

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.