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

Date: 3/31/21

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 3/31/21 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.

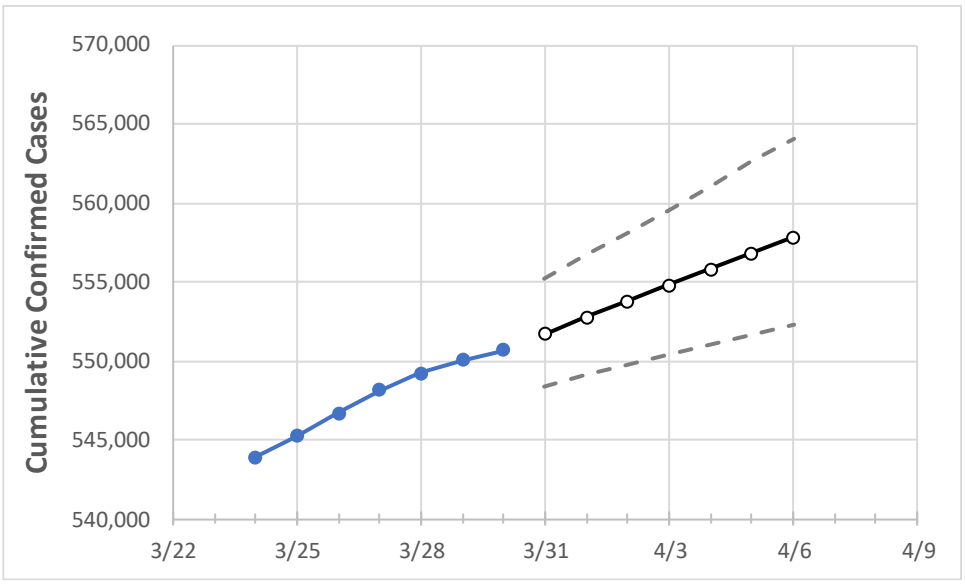
IEM's Modeling Lead

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
South Carolina	548,114	549,199	550,068	550,669	551,704	552,753	553,774	554,801	555,798	556,809	557,815

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Beaufort	16,194	16,214	16,226	16,244	16,264	16,284	16,304	16,323	16,342	16,361	16,379
Charleston	40,370	40,436	40,504	40,535	40,609	40,679	40,751	40,823	40,893	40,960	41,028
Greenville	68,760	68,968	69,112	69,241	69,454	69,672	69,890	70,116	70,344	70,572	70,805
Kershaw	7,013	7,029	7,038	7,046	7,056	7,066	7,076	7,086	7,095	7,105	7,115
Lexington	31,422	31,479	31,515	31,555	31,610	31,663	31,716	31,770	31,824	31,876	31,931
Richland	43,598	43,687	43,745	43,796	43,868	43,938	44,008	44,077	44,145	44,213	44,282
Spartanburg	38,394	38,533	38,647	38,697	38,803	38,912	39,023	39,134	39,249	39,357	39,473
York	28,408	28,450	28,509	28,550	28,602	28,653	28,704	28,753	28,804	28,852	28,900

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:		
	3/27	3/28	3/29	3/30	4/1	4/3	4/5
Beaufort	16,194	16,214	16,226	16,244	16,284 (3,257) [782] {391}	16,323 (3,265) [783] {392}	16,361 (3,272) [785] {393}
Charleston	40,370	40,436	40,504	40,535	40,679 (8,136) [1,953] {976}	40,823 (8,165) [1,960] {980}	40,960 (8,192) [1,966] {983}
Greenville	68,760	68,968	69,112	69,241	69,672 (13,934) [3,344] {1,672}	70,116 (14,023) [3,366] {1,683}	70,572 (14,114) [3,387] {1,694}
Kershaw	7,013	7,029	7,038	7,046	7,066 (1,413) [339] {170}	7,086 (1,417) [340] {170}	7,105 (1,421) [341] {171}
Lexington	31,422	31,479	31,515	31,555	31,663 (6,333) [1,520] {760}	31,770 (6,354) [1,525] {762}	31,876 (6,375) [1,530] {765}
Richland	43,598	43,687	43,745	43,796	43,938 (8,788) [2,109] {1,055}	44,077 (8,815) [2,116] {1,058}	44,213 (8,843) [2,122] {1,061}
Spartanburg	38,394	38,533	38,647	38,697	38,912 (7,782) [1,868] {934}	39,134 (7,827) [1,878] {939}	39,357 (7,871) [1,889] {945}
York	28,408	28,450	28,509	28,550	28,653 (5,731) [1,375] {688}	28,753 (5,751) [1,380] {690}	28,852 (5,770) [1,385] {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.