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

Date: 6/23/21

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 6/23/21 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.

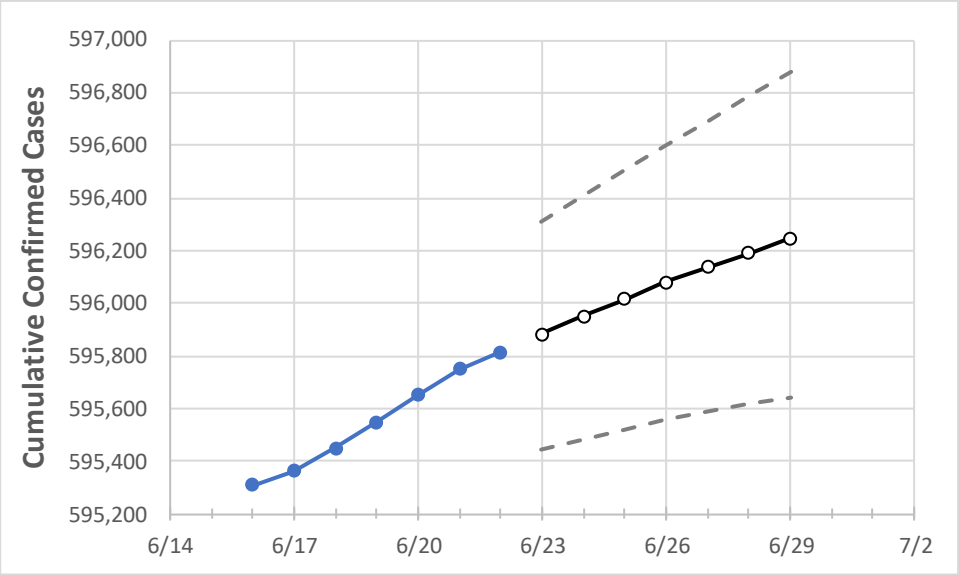
IEM's Modeling Lead

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:						
	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29
South Carolina	595,549	595,649	595,750	595,813	595,882	595,952	596,016	596,078	596,138	596,191	596,247

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:						
	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29
Beaufort	17,101	17,103	17,104	17,108	17,110	17,111	17,113	17,114	17,116	17,117	17,118
Charleston	43,887	43,887	43,887	43,900	43,903	43,907	43,910	43,913	43,916	43,918	43,921
Greenville	75,525	75,540	75,555	75,559	75,573	75,586	75,599	75,612	75,624	75,636	75,648
Kershaw	7,543	7,542	7,541	7,541	7,547	7,554	7,561	7,568	7,575	7,583	7,591
Lexington	33,713	33,713	33,712	33,715	33,719	33,722	33,726	33,729	33,732	33,735	33,738
Richland	47,416	47,439	47,463	47,467	47,482	47,496	47,511	47,525	47,540	47,554	47,569
Spartanburg	41,979	41,983	41,988	41,990	41,995	42,000	42,005	42,010	42,014	42,018	42,023
York	31,958	31,962	31,965	31,967	31,972	31,976	31,981	31,985	31,989	31,992	31,996

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:		
	6/19	6/20	6/21	6/22	6/24	6/26	6/28
Beaufort	17,101	17,103	17,104	17,108	17,111 (3,422) [821] {411}	17,114 (3,423) [821] {411}	17,117 (3,423) [822] {411}
Charleston	43,887	43,887	43,887	43,900	43,907 (8,781) [2,108] {1,054}	43,913 (8,783) [2,108] {1,054}	43,918 (8,784) [2,108] {1,054}
Greenville	75,525	75,540	75,555	75,559	75,586 (15,117) [3,628] {1,814}	75,612 (15,122) [3,629] {1,815}	75,636 (15,127) [3,631] {1,815}
Kershaw	7,543	7,542	7,541	7,541	7,554 (1,511) [363] {181}	7,568 (1,514) [363] {182}	7,583 (1,517) [364] {182}
Lexington	33,713	33,713	33,712	33,715	33,722 (6,744) [1,619] {809}	33,729 (6,746) [1,619] {809}	33,735 (6,747) [1,619] {810}
Richland	47,416	47,439	47,463	47,467	47,496 (9,499) [2,280] {1,140}	47,525 (9,505) [2,281] {1,141}	47,554 (9,511) [2,283] {1,141}
Spartanburg	41,979	41,983	41,988	41,990	42,000 (8,400) [2,016] {1,008}	42,010 (8,402) [2,016] {1,008}	42,018 (8,404) [2,017] {1,008}
York	31,958	31,962	31,965	31,967	31,976 (6,395) [1,535] {767}	31,985 (6,397) [1,535] {768}	31,992 (6,398) [1,536] {768}

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.