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

Date: 5/19/21

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 5/19/21 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.

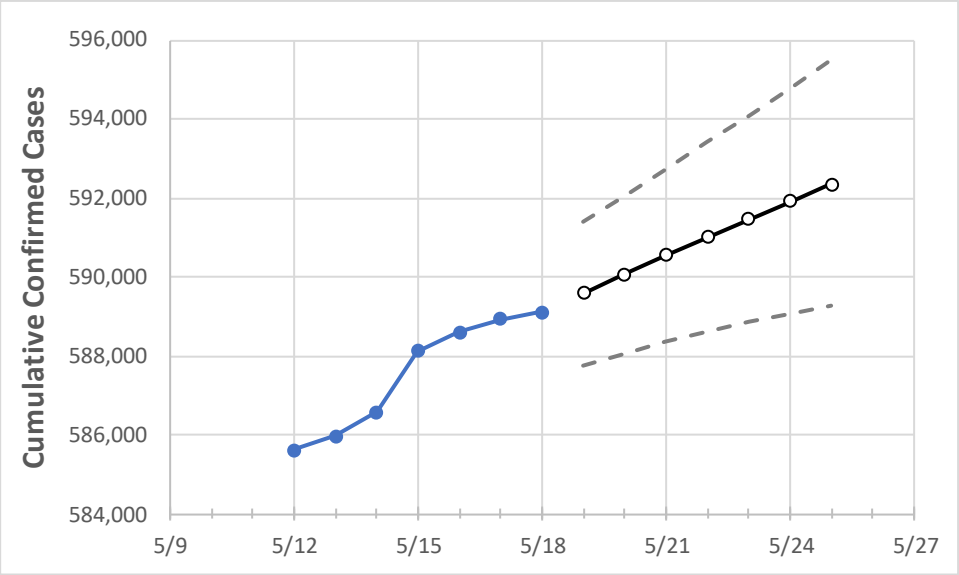
IEM's Modeling Lead

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:						
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25
South Carolina	588,110	588,593	588,939	589,098	589,588	590,077	590,539	590,997	591,459	591,917	592,351

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:						
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25
Beaufort	16,898	16,912	16,929	16,936	16,948	16,959	16,971	16,982	16,993	17,005	17,017
Charleston	43,482	43,507	43,525	43,532	43,550	43,566	43,582	43,598	43,612	43,626	43,638
Greenville	74,593	74,708	74,743	74,767	74,822	74,876	74,927	74,976	75,024	75,070	75,116
Kershaw	7,507	7,510	7,512	7,514	7,518	7,521	7,525	7,528	7,532	7,535	7,539
Lexington	33,444	33,456	33,472	33,477	33,500	33,523	33,545	33,567	33,588	33,610	33,630
Richland	46,798	46,828	46,855	46,868	46,903	46,938	46,973	47,006	47,039	47,071	47,102
Spartanburg	41,462	41,490	41,525	41,530	41,562	41,593	41,620	41,649	41,679	41,706	41,734
York	31,381	31,409	31,438	31,455	31,486	31,517	31,547	31,575	31,603	31,630	31,656

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:		
	5/15	5/16	5/17	5/18	5/20	5/22	5/24
Beaufort	16,898	16,912	16,929	16,936	16,959 (3,392) [814] {407}	16,982 (3,396) [815] {408}	17,005 (3,401) [816] {408}
Charleston	43,482	43,507	43,525	43,532	43,566 (8,713) [2,091] {1,046}	43,598 (8,720) [2,093] {1,046}	43,626 (8,725) [2,094] {1,047}
Greenville	74,593	74,708	74,743	74,767	74,876 (14,975) [3,594] {1,797}	74,976 (14,995) [3,599] {1,799}	75,070 (15,014) [3,603] {1,802}
Kershaw	7,507	7,510	7,512	7,514	7,521 (1,504) [361] {181}	7,528 (1,506) [361] {181}	7,535 (1,507) [362] {181}
Lexington	33,444	33,456	33,472	33,477	33,523 (6,705) [1,609] {805}	33,567 (6,713) [1,611] {806}	33,610 (6,722) [1,613] {807}
Richland	46,798	46,828	46,855	46,868	46,938 (9,388) [2,253] {1,127}	47,006 (9,401) [2,256] {1,128}	47,071 (9,414) [2,259] {1,130}
Spartanburg	41,462	41,490	41,525	41,530	41,593 (8,319) [1,996] {998}	41,649 (8,330) [1,999] {1,000}	41,706 (8,341) [2,002] {1,001}
York	31,381	31,409	31,438	31,455	31,517 (6,303) [1,513] {756}	31,575 (6,315) [1,516] {758}	31,630 (6,326) [1,518] {759}

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.