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

Date: 5/17/21

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 5/17/21 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.

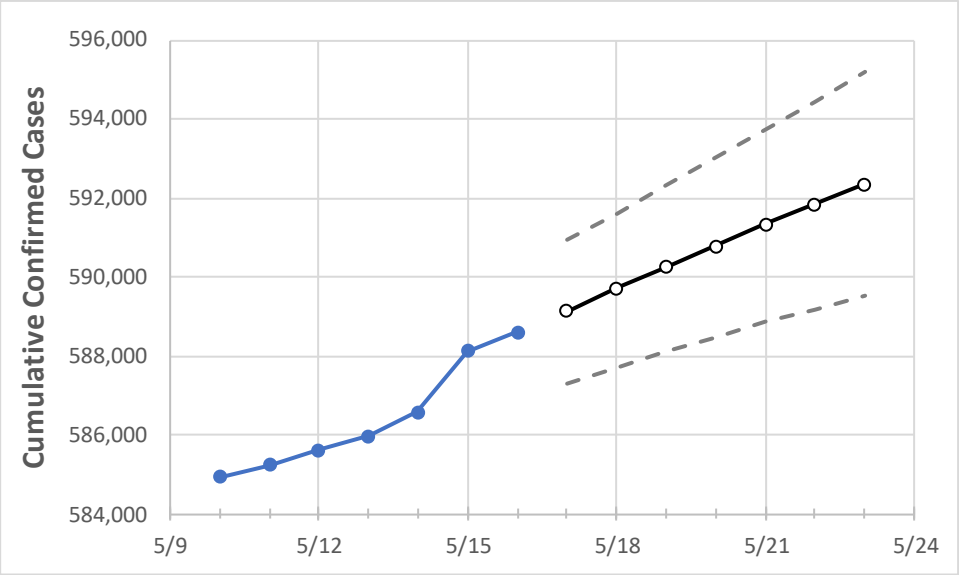
IEM's Modeling Lead

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:						
	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23
South Carolina	585,957	586,585	588,110	588,593	589,142	589,701	590,236	590,781	591,329	591,851	592,359

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:						
	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23
Beaufort	16,805	16,820	16,898	16,912	16,923	16,935	16,946	16,957	16,968	16,980	16,991
Charleston	43,195	43,236	43,482	43,507	43,532	43,557	43,581	43,603	43,625	43,646	43,666
Greenville	74,423	74,494	74,593	74,708	74,774	74,835	74,896	74,956	75,015	75,075	75,135
Kershaw	7,491	7,494	7,507	7,510	7,514	7,519	7,523	7,527	7,531	7,534	7,538
Lexington	33,359	33,385	33,444	33,456	33,482	33,508	33,534	33,560	33,586	33,611	33,636
Richland	46,629	46,696	46,798	46,828	46,873	46,917	46,961	47,004	47,046	47,086	47,129
Spartanburg	41,351	41,395	41,462	41,490	41,529	41,566	41,604	41,642	41,679	41,716	41,752
York	31,247	31,289	31,381	31,409	31,448	31,486	31,523	31,559	31,594	31,630	31,663

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:		
	5/13	5/14	5/15	5/16	5/18	5/20	5/22
Beaufort	16,805	16,820	16,898	16,912	16,935 (3,387) [813] {406}	16,957 (3,391) [814] {407}	16,980 (3,396) [815] {408}
Charleston	43,195	43,236	43,482	43,507	43,557 (8,711) [2,091] {1,045}	43,603 (8,721) [2,093] {1,046}	43,646 (8,729) [2,095] {1,048}
Greenville	74,423	74,494	74,593	74,708	74,835 (14,967) [3,592] {1,796}	74,956 (14,991) [3,598] {1,799}	75,075 (15,015) [3,604] {1,802}
Kershaw	7,491	7,494	7,507	7,510	7,519 (1,504) [361] {180}	7,527 (1,505) [361] {181}	7,534 (1,507) [362] {181}
Lexington	33,359	33,385	33,444	33,456	33,508 (6,702) [1,608] {804}	33,560 (6,712) [1,611] {805}	33,611 (6,722) [1,613] {807}
Richland	46,629	46,696	46,798	46,828	46,917 (9,383) [2,252] {1,126}	47,004 (9,401) [2,256] {1,128}	47,086 (9,417) [2,260] {1,130}
Spartanburg	41,351	41,395	41,462	41,490	41,566 (8,313) [1,995] {998}	41,642 (8,328) [1,999] {999}	41,716 (8,343) [2,002] {1,001}
York	31,247	31,289	31,381	31,409	31,486 (6,297) [1,511] {756}	31,559 (6,312) [1,515] {757}	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.