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

Date: 5/25/21

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 5/25/21 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.

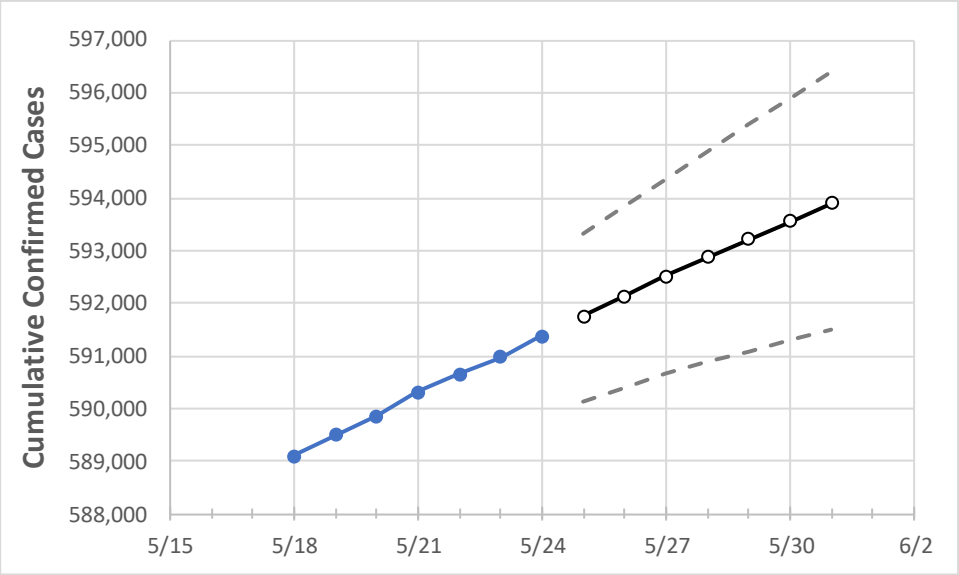
IEM's Modeling Lead

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
South Carolina	590,314	590,645	590,981	591,365	591,760	592,138	592,511	592,869	593,218	593,563	593,904

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Beaufort	16,970	16,980	16,989	17,003	17,015	17,027	17,039	17,051	17,062	17,075	17,087
Charleston	43,621	43,630	43,641	43,674	43,691	43,707	43,722	43,736	43,750	43,763	43,776
Greenville	74,888	74,923	74,958	74,996	75,033	75,069	75,105	75,139	75,171	75,202	75,232
Kershaw	7,522	7,525	7,526	7,533	7,536	7,539	7,542	7,545	7,547	7,550	7,553
Lexington	33,533	33,545	33,556	33,570	33,587	33,603	33,618	33,633	33,647	33,662	33,675
Richland	46,957	46,985	47,023	47,050	47,078	47,106	47,133	47,160	47,187	47,212	47,236
Spartanburg	41,600	41,627	41,646	41,682	41,706	41,730	41,752	41,774	41,796	41,816	41,836
York	31,589	31,629	31,669	31,693	31,727	31,759	31,791	31,823	31,854	31,883	31,913

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:		
	5/21	5/22	5/23	5/24	5/26	5/28	5/30
Beaufort	16,970	16,980	16,989	17,003	17,027 (3,405) [817] {409}	17,051 (3,410) [818] {409}	17,075 (3,415) [820] {410}
Charleston	43,621	43,630	43,641	43,674	43,707 (8,741) [2,098] {1,049}	43,736 (8,747) [2,099] {1,050}	43,763 (8,753) [2,101] {1,050}
Greenville	74,888	74,923	74,958	74,996	75,069 (15,014) [3,603] {1,802}	75,139 (15,028) [3,607] {1,803}	75,202 (15,040) [3,610] {1,805}
Kershaw	7,522	7,525	7,526	7,533	7,539 (1,508) [362] {181}	7,545 (1,509) [362] {181}	7,550 (1,510) [362] {181}
Lexington	33,533	33,545	33,556	33,570	33,603 (6,721) [1,613] {806}	33,633 (6,727) [1,614] {807}	33,662 (6,732) [1,616] {808}
Richland	46,957	46,985	47,023	47,050	47,106 (9,421) [2,261] {1,131}	47,160 (9,432) [2,264] {1,132}	47,212 (9,442) [2,266] {1,133}
Spartanburg	41,600	41,627	41,646	41,682	41,730 (8,346) [2,003] {1,002}	41,774 (8,355) [2,005] {1,003}	41,816 (8,363) [2,007] {1,004}
York	31,589	31,629	31,669	31,693	31,759 (6,352) [1,524] {762}	31,823 (6,365) [1,527] {764}	31,883 (6,377) [1,530] {765}

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.