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

Date: 5/28/21

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 5/28/21 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.

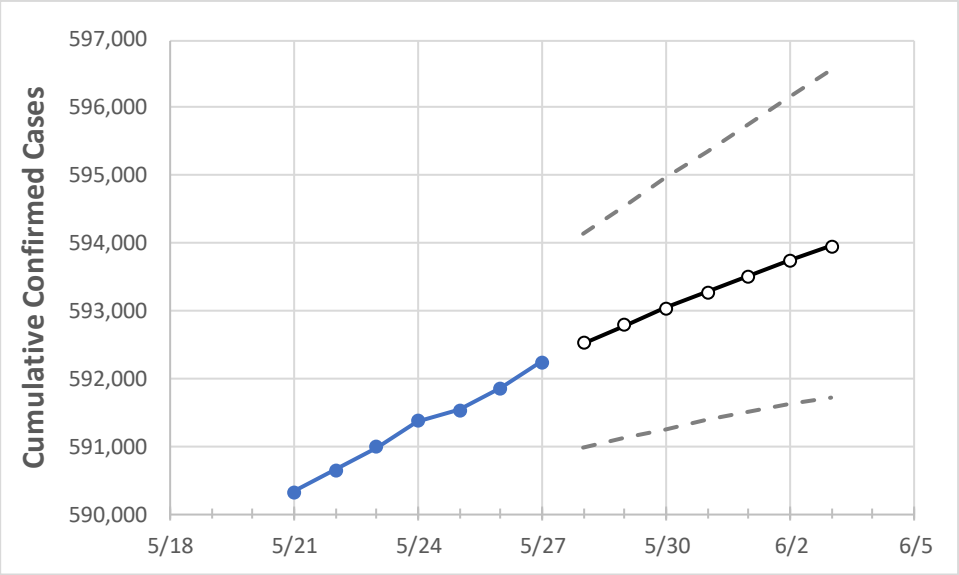
IEM's Modeling Lead

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
South Carolina	591,365	591,525	591,862	592,243	592,521	592,780	593,034	593,278	593,515	593,743	593,957

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Beaufort	17,003	17,007	17,025	17,036	17,047	17,059	17,070	17,082	17,093	17,105	17,117
Charleston	43,674	43,683	43,701	43,730	43,747	43,762	43,778	43,792	43,807	43,821	43,835
Greenville	74,996	75,019	75,032	75,067	75,092	75,118	75,141	75,162	75,182	75,202	75,221
Kershaw	7,533	7,535	7,537	7,542	7,544	7,547	7,549	7,551	7,553	7,554	7,556
Lexington	33,570	33,582	33,605	33,644	33,658	33,672	33,685	33,697	33,710	33,722	33,734
Richland	47,050	47,061	47,079	47,100	47,119	47,138	47,155	47,171	47,188	47,204	47,218
Spartanburg	41,682	41,690	41,713	41,729	41,745	41,760	41,775	41,789	41,802	41,814	41,825
York	31,693	31,710	31,736	31,770	31,800	31,829	31,857	31,886	31,913	31,940	31,965

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:		
	5/24	5/25	5/26	5/27	5/29	5/31	6/2
Beaufort	17,003	17,007	17,025	17,036	17,059 (3,412) [819] {409}	17,082 (3,416) [820] {410}	17,105 (3,421) [821] {411}
Charleston	43,674	43,683	43,701	43,730	43,762 (8,752) [2,101] {1,050}	43,792 (8,758) [2,102] {1,051}	43,821 (8,764) [2,103] {1,052}
Greenville	74,996	75,019	75,032	75,067	75,118 (15,024) [3,606] {1,803}	75,162 (15,032) [3,608] {1,804}	75,202 (15,040) [3,610] {1,805}
Kershaw	7,533	7,535	7,537	7,542	7,547 (1,509) [362] {181}	7,551 (1,510) [362] {181}	7,554 (1,511) [363] {181}
Lexington	33,570	33,582	33,605	33,644	33,672 (6,734) [1,616] {808}	33,697 (6,739) [1,617] {809}	33,722 (6,744) [1,619] {809}
Richland	47,050	47,061	47,079	47,100	47,138 (9,428) [2,263] {1,131}	47,171 (9,434) [2,264] {1,132}	47,204 (9,441) [2,266] {1,133}
Spartanburg	41,682	41,690	41,713	41,729	41,760 (8,352) [2,004] {1,002}	41,789 (8,358) [2,006] {1,003}	41,814 (8,363) [2,007] {1,004}
York	31,693	31,710	31,736	31,770	31,829 (6,366) [1,528] {764}	31,886 (6,377) [1,531] {765}	31,940 (6,388) [1,533] {767}

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.