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

Date: 5/27/21

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 5/27/21 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.

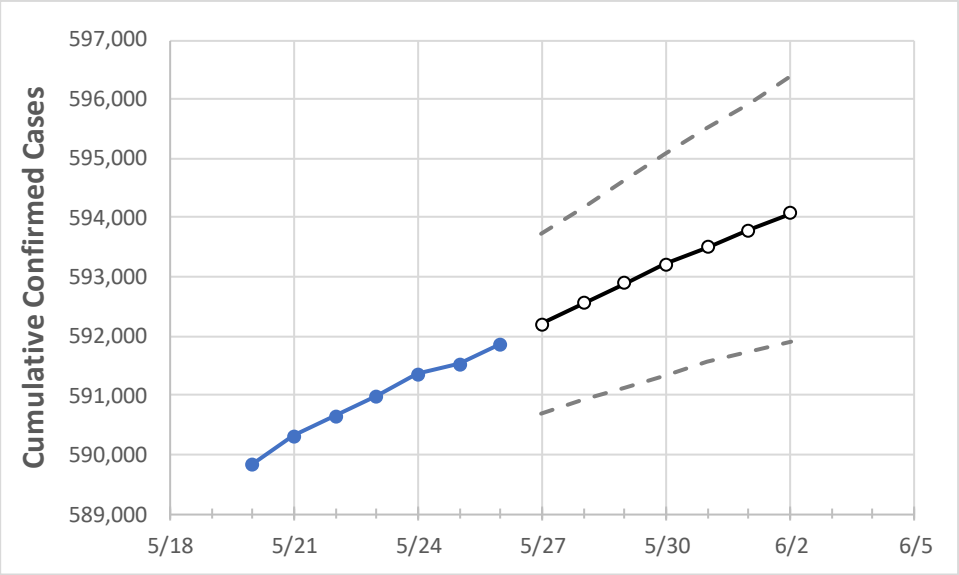
IEM's Modeling Lead

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:						
	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2
South Carolina	590,981	591,365	591,525	591,862	592,205	592,556	592,888	593,209	593,504	593,794	594,083

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:						
	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2
Beaufort	16,989	17,003	17,007	17,025	17,036	17,048	17,060	17,072	17,084	17,095	17,107
Charleston	43,641	43,674	43,683	43,701	43,716	43,731	43,745	43,759	43,773	43,786	43,798
Greenville	74,958	74,996	75,019	75,032	75,065	75,099	75,129	75,159	75,187	75,215	75,242
Kershaw	7,526	7,533	7,535	7,537	7,540	7,543	7,545	7,548	7,550	7,552	7,555
Lexington	33,556	33,570	33,582	33,605	33,620	33,634	33,649	33,663	33,676	33,689	33,702
Richland	47,023	47,050	47,061	47,079	47,104	47,130	47,154	47,177	47,200	47,221	47,242
Spartanburg	41,646	41,682	41,690	41,713	41,735	41,757	41,779	41,800	41,820	41,839	41,859
York	31,669	31,693	31,710	31,736	31,767	31,796	31,825	31,853	31,881	31,907	31,934

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:		
	5/23	5/24	5/25	5/26	5/28	5/30	6/1
Beaufort	16,989	17,003	17,007	17,025	17,048 (3,410) [818] {409}	17,072 (3,414) [819] {410}	17,095 (3,419) [821] {410}
Charleston	43,641	43,674	43,683	43,701	43,731 (8,746) [2,099] {1,050}	43,759 (8,752) [2,100] {1,050}	43,786 (8,757) [2,102] {1,051}
Greenville	74,958	74,996	75,019	75,032	75,099 (15,020) [3,605] {1,802}	75,159 (15,032) [3,608] {1,804}	75,215 (15,043) [3,610] {1,805}
Kershaw	7,526	7,533	7,535	7,537	7,543 (1,509) [362] {181}	7,548 (1,510) [362] {181}	7,552 (1,510) [363] {181}
Lexington	33,556	33,570	33,582	33,605	33,634 (6,727) [1,614] {807}	33,663 (6,733) [1,616] {808}	33,689 (6,738) [1,617] {809}
Richland	47,023	47,050	47,061	47,079	47,130 (9,426) [2,262] {1,131}	47,177 (9,435) [2,264] {1,132}	47,221 (9,444) [2,267] {1,133}
Spartanburg	41,646	41,682	41,690	41,713	41,757 (8,351) [2,004] {1,002}	41,800 (8,360) [2,006] {1,003}	41,839 (8,368) [2,008] {1,004}
York	31,669	31,693	31,710	31,736	31,796 (6,359) [1,526] {763}	31,853 (6,371) [1,529] {764}	31,907 (6,381) [1,532] {766}

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.