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

Date: 5/26/21

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 5/26/21 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.

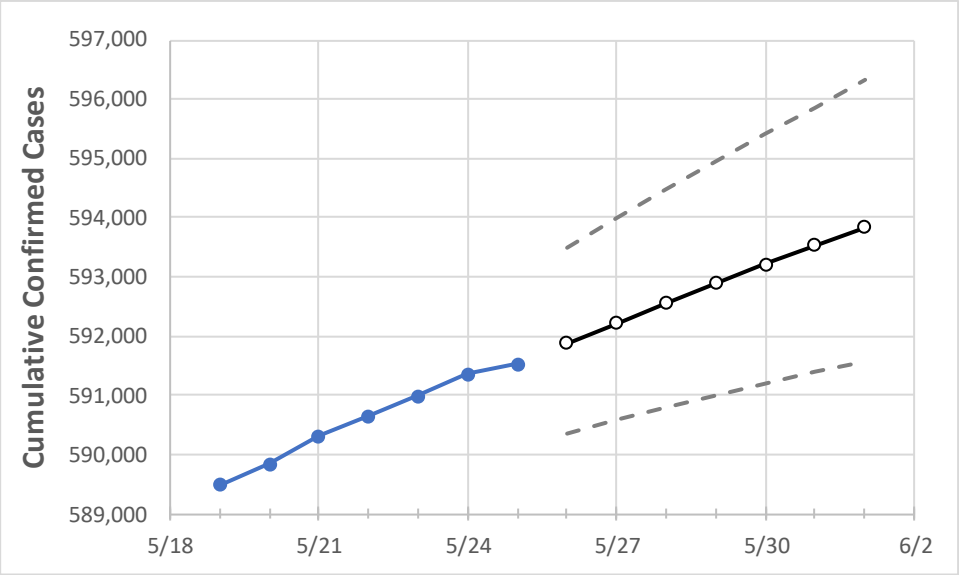
IEM's Modeling Lead

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
South Carolina	590,645	590,981	591,365	591,525	591,878	592,218	592,551	592,890	593,211	593,538	593,847

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
Beaufort	16,980	16,989	17,003	17,007	17,017	17,027	17,038	17,048	17,058	17,068	17,078
Charleston	43,630	43,641	43,674	43,683	43,699	43,714	43,728	43,743	43,757	43,771	43,783
Greenville	74,923	74,958	74,996	75,019	75,054	75,088	75,121	75,153	75,184	75,214	75,242
Kershaw	7,525	7,526	7,533	7,533	7,536	7,539	7,542	7,545	7,547	7,550	7,552
Lexington	33,545	33,556	33,570	33,582	33,598	33,613	33,628	33,642	33,656	33,669	33,682
Richland	46,985	47,023	47,050	47,061	47,087	47,113	47,137	47,162	47,185	47,208	47,229
Spartanburg	41,627	41,646	41,682	41,690	41,713	41,735	41,757	41,778	41,799	41,819	41,839
York	31,629	31,669	31,693	31,710	31,740	31,771	31,800	31,828	31,856	31,883	31,909

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:		
	5/22	5/23	5/24	5/25	5/27	5/29	5/31
Beaufort	16,980	16,989	17,003	17,007	17,027 (3,405) [817] {409}	17,048 (3,410) [818] {409}	17,068 (3,414) [819] {410}
Charleston	43,630	43,641	43,674	43,683	43,714 (8,743) [2,098] {1,049}	43,743 (8,749) [2,100] {1,050}	43,771 (8,754) [2,101] {1,050}
Greenville	74,923	74,958	74,996	75,019	75,088 (15,018) [3,604] {1,802}	75,153 (15,031) [3,607] {1,804}	75,214 (15,043) [3,610] {1,805}
Kershaw	7,525	7,526	7,533	7,533	7,539 (1,508) [362] {181}	7,545 (1,509) [362] {181}	7,550 (1,510) [362] {181}
Lexington	33,545	33,556	33,570	33,582	33,613 (6,723) [1,613] {807}	33,642 (6,728) [1,615] {807}	33,669 (6,734) [1,616] {808}
Richland	46,985	47,023	47,050	47,061	47,113 (9,423) [2,261] {1,131}	47,162 (9,432) [2,264] {1,132}	47,208 (9,442) [2,266] {1,133}
Spartanburg	41,627	41,646	41,682	41,690	41,735 (8,347) [2,003] {1,002}	41,778 (8,356) [2,005] {1,003}	41,819 (8,364) [2,007] {1,004}
York	31,629	31,669	31,693	31,710	31,771 (6,354) [1,525] {762}	31,828 (6,366) [1,528] {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.