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

Date: 7/7/21

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 7/7/21 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.

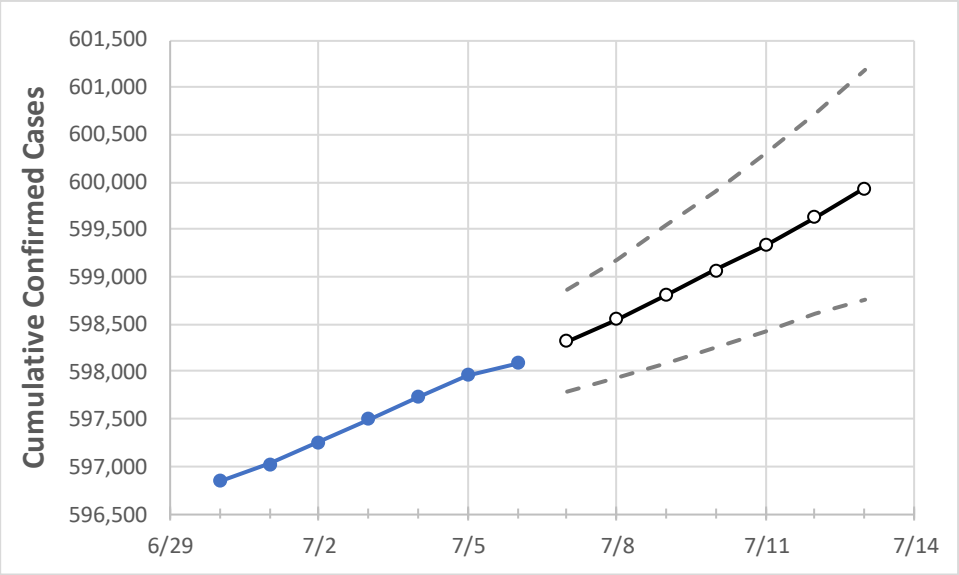
IEM's Modeling Lead

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
South Carolina	597,494	597,728	597,961	598,093	598,322	598,559	598,803	599,068	599,337	599,627	599,930

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Beaufort	17,161	17,168	17,175	17,178	17,186	17,195	17,203	17,213	17,222	17,232	17,243
Charleston	43,996	44,018	44,039	44,047	44,064	44,082	44,101	44,122	44,144	44,168	44,193
Greenville	75,706	75,707	75,709	75,715	75,722	75,729	75,736	75,743	75,749	75,754	75,760
Kershaw	7,558	7,561	7,565	7,567	7,569	7,571	7,573	7,575	7,578	7,580	7,582
Lexington	33,784	33,807	33,829	33,844	33,863	33,883	33,904	33,928	33,954	33,982	34,013
Richland	47,751	47,786	47,820	47,846	47,880	47,914	47,947	47,982	48,019	48,058	48,100
Spartanburg	42,075	42,076	42,077	42,081	42,086	42,090	42,094	42,099	42,102	42,106	42,110
York	32,118	32,148	32,177	32,191	32,223	32,257	32,294	32,334	32,377	32,425	32,476

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:		
	7/3	7/4	7/5	7/6	7/8	7/10	7/12
Beaufort	17,161	17,168	17,175	17,178	17,195 (3,439) [825] {413}	17,213 (3,443) [826] {413}	17,232 (3,446) [827] {414}
Charleston	43,996	44,018	44,039	44,047	44,082 (8,816) [2,116] {1,058}	44,122 (8,824) [2,118] {1,059}	44,168 (8,834) [2,120] {1,060}
Greenville	75,706	75,707	75,709	75,715	75,729 (15,146) [3,635] {1,818}	75,743 (15,149) [3,636] {1,818}	75,754 (15,151) [3,636] {1,818}
Kershaw	7,558	7,561	7,565	7,567	7,571 (1,514) [363] {182}	7,575 (1,515) [364] {182}	7,580 (1,516) [364] {182}
Lexington	33,784	33,807	33,829	33,844	33,883 (6,777) [1,626] {813}	33,928 (6,786) [1,629] {814}	33,982 (6,796) [1,631] {816}
Richland	47,751	47,786	47,820	47,846	47,914 (9,583) [2,300] {1,150}	47,982 (9,596) [2,303] {1,152}	48,058 (9,612) [2,307] {1,153}
Spartanburg	42,075	42,076	42,077	42,081	42,090 (8,418) [2,020] {1,010}	42,099 (8,420) [2,021] {1,010}	42,106 (8,421) [2,021] {1,011}
York	32,118	32,148	32,177	32,191	32,257 (6,451) [1,548] {774}	32,334 (6,467) [1,552] {776}	32,425 (6,485) [1,556] {778}

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.