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

Date: 7/2/21

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 7/2/21 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.

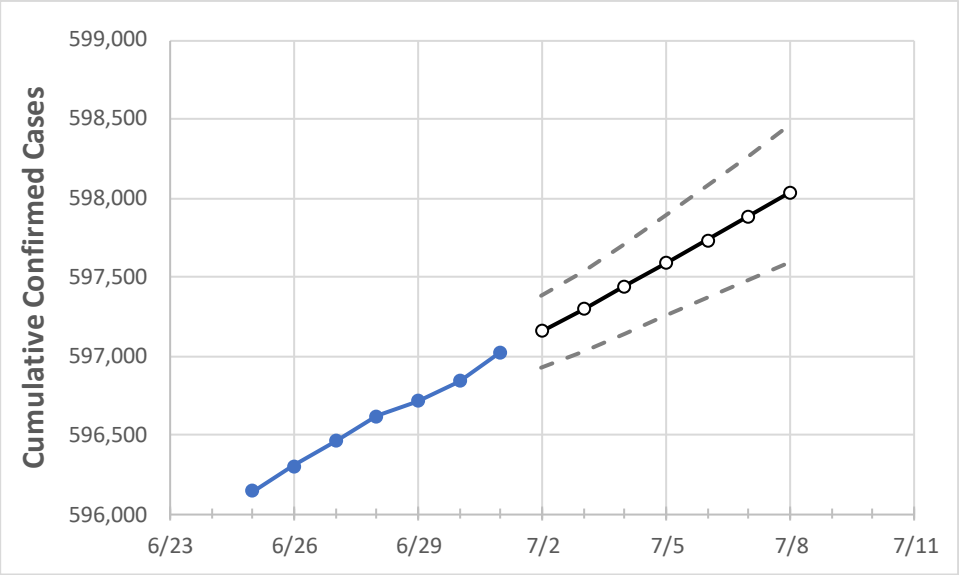
IEM's Modeling Lead

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
South Carolina	596,616	596,712	596,840	597,021	597,157	597,298	597,441	597,587	597,735	597,884	598,036

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:						
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8
Beaufort	17,130	17,135	17,134	17,149	17,154	17,159	17,165	17,171	17,177	17,182	17,189
Charleston	43,938	43,947	43,958	43,960	43,965	43,969	43,974	43,978	43,983	43,987	43,991
Greenville	75,651	75,661	75,672	75,688	75,701	75,713	75,725	75,737	75,749	75,760	75,772
Kershaw	7,548	7,549	7,549	7,550	7,551	7,552	7,552	7,553	7,554	7,555	7,555
Lexington	33,729	33,736	33,739	33,747	33,750	33,752	33,755	33,757	33,759	33,761	33,764
Richland	47,628	47,637	47,657	47,664	47,688	47,713	47,738	47,762	47,788	47,814	47,840
Spartanburg	42,044	42,045	42,053	42,064	42,070	42,077	42,084	42,090	42,097	42,103	42,110
York	32,004	32,013	32,026	32,060	32,074	32,088	32,103	32,118	32,135	32,151	32,168

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:		
	6/28	6/29	6/30	7/1	7/3	7/5	7/7
Beaufort	17,130	17,135	17,134	17,149	17,159 (3,432) [824] {412}	17,171 (3,434) [824] {412}	17,182 (3,436) [825] {412}
Charleston	43,938	43,947	43,958	43,960	43,969 (8,794) [2,111] {1,055}	43,978 (8,796) [2,111] {1,055}	43,987 (8,797) [2,111] {1,056}
Greenville	75,651	75,661	75,672	75,688	75,713 (15,143) [3,634] {1,817}	75,737 (15,147) [3,635] {1,818}	75,760 (15,152) [3,636] {1,818}
Kershaw	7,548	7,549	7,549	7,550	7,552 (1,510) [362] {181}	7,553 (1,511) [363] {181}	7,555 (1,511) [363] {181}
Lexington	33,729	33,736	33,739	33,747	33,752 (6,750) [1,620] {810}	33,757 (6,751) [1,620] {810}	33,761 (6,752) [1,621] {810}
Richland	47,628	47,637	47,657	47,664	47,713 (9,543) [2,290] {1,145}	47,762 (9,552) [2,293] {1,146}	47,814 (9,563) [2,295] {1,148}
Spartanburg	42,044	42,045	42,053	42,064	42,077 (8,415) [2,020] {1,010}	42,090 (8,418) [2,020] {1,010}	42,103 (8,421) [2,021] {1,010}
York	32,004	32,013	32,026	32,060	32,088 (6,418) [1,540] {770}	32,118 (6,424) [1,542] {771}	32,151 (6,430) [1,543] {772}

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.