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

Date: 7/16/21

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 7/16/21 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.

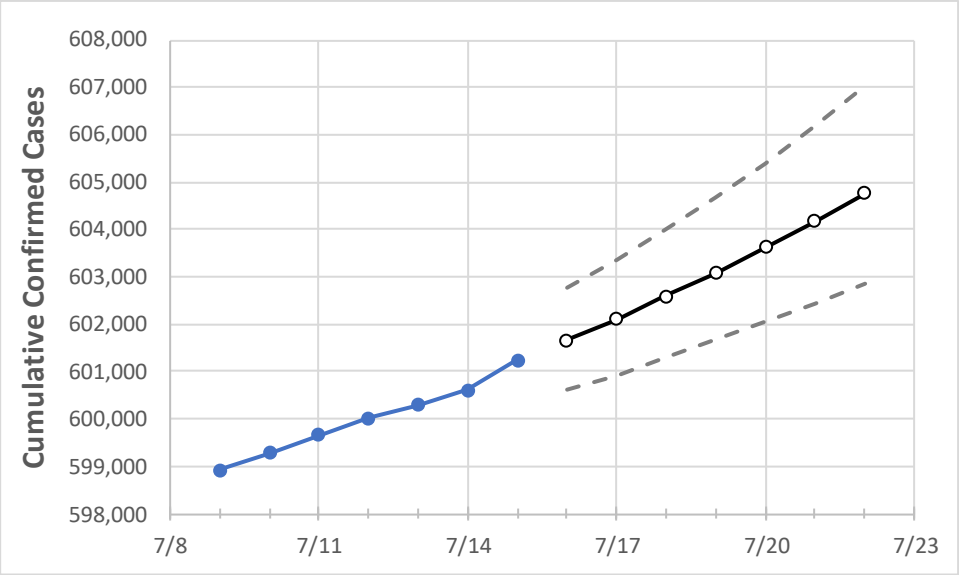
IEM's Modeling Lead

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
South Carolina	600,027	600,283	600,607	601,232	601,660	602,113	602,585	603,087	603,621	604,184	604,774

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Beaufort	17,236	17,238	17,246	17,267	17,278	17,290	17,303	17,315	17,329	17,343	17,359
Charleston	44,220	44,236	44,269	44,317	44,358	44,403	44,450	44,502	44,557	44,617	44,682
Greenville	75,815	75,836	75,872	75,946	75,968	75,991	76,014	76,038	76,064	76,091	76,118
Kershaw	7,601	7,603	7,606	7,618	7,625	7,632	7,640	7,648	7,656	7,666	7,675
Lexington	34,051	34,072	34,090	34,142	34,189	34,238	34,292	34,351	34,415	34,484	34,560
Richland	48,044	48,071	48,093	48,137	48,174	48,213	48,253	48,292	48,334	48,377	48,421
Spartanburg	42,126	42,142	42,157	42,192	42,202	42,213	42,224	42,236	42,247	42,260	42,273
York	32,354	32,372	32,388	32,412	32,444	32,477	32,512	32,548	32,584	32,622	32,661

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:		
	7/12	7/13	7/14	7/15	7/17	7/19	7/21
Beaufort	17,236	17,238	17,246	17,267	17,290 (3,458) [830] {415}	17,315 (3,463) [831] {416}	17,343 (3,469) [832] {416}
Charleston	44,220	44,236	44,269	44,317	44,403 (8,881) [2,131] {1,066}	44,502 (8,900) [2,136] {1,068}	44,617 (8,923) [2,142] {1,071}
Greenville	75,815	75,836	75,872	75,946	75,991 (15,198) [3,648] {1,824}	76,038 (15,208) [3,650] {1,825}	76,091 (15,218) [3,652] {1,826}
Kershaw	7,601	7,603	7,606	7,618	7,632 (1,526) [366] {183}	7,648 (1,530) [367] {184}	7,666 (1,533) [368] {184}
Lexington	34,051	34,072	34,090	34,142	34,238 (6,848) [1,643] {822}	34,351 (6,870) [1,649] {824}	34,484 (6,897) [1,655] {828}
Richland	48,044	48,071	48,093	48,137	48,213 (9,643) [2,314] {1,157}	48,292 (9,658) [2,318] {1,159}	48,377 (9,675) [2,322] {1,161}
Spartanburg	42,126	42,142	42,157	42,192	42,213 (8,443) [2,026] {1,013}	42,236 (8,447) [2,027] {1,014}	42,260 (8,452) [2,028] {1,014}
York	32,354	32,372	32,388	32,412	32,477 (6,495) [1,559] {779}	32,548 (6,510) [1,562] {781}	32,622 (6,524) [1,566] {783}

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.