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

Date: 7/14/21

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 7/14/21 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.

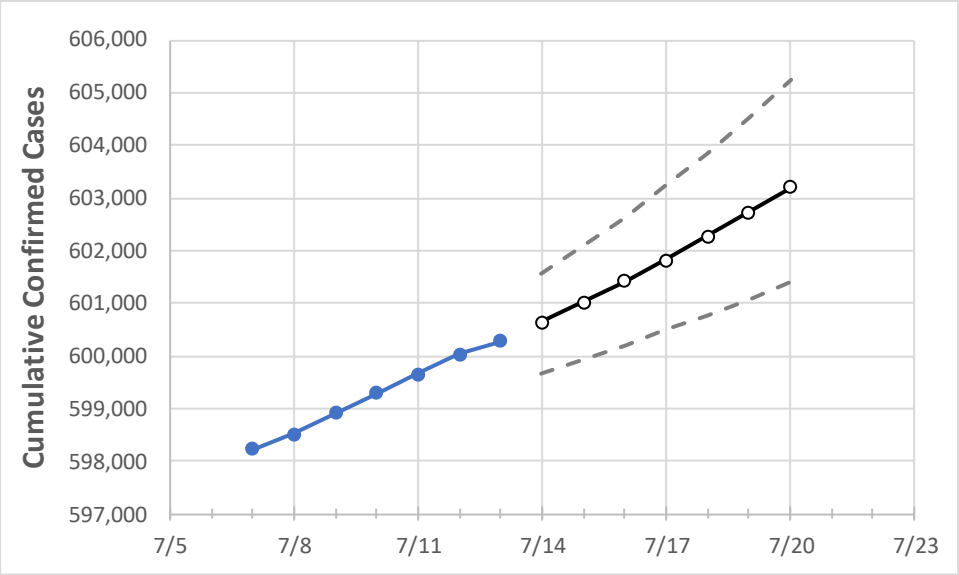
IEM's Modeling Lead

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
South Carolina	599,288	599,657	600,027	600,283	600,641	601,014	601,410	601,824	602,264	602,724	603,206

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Beaufort	17,213	17,224	17,236	17,238	17,247	17,257	17,267	17,277	17,287	17,298	17,309
Charleston	44,155	44,188	44,220	44,236	44,269	44,304	44,343	44,384	44,429	44,475	44,526
Greenville	75,775	75,795	75,815	75,836	75,850	75,865	75,879	75,894	75,909	75,924	75,939
Kershaw	7,583	7,592	7,601	7,603	7,608	7,613	7,619	7,625	7,632	7,639	7,646
Lexington	33,956	34,004	34,051	34,072	34,117	34,166	34,219	34,278	34,342	34,412	34,492
Richland	47,969	48,006	48,044	48,071	48,106	48,142	48,177	48,215	48,254	48,295	48,337
Spartanburg	42,117	42,121	42,126	42,142	42,149	42,156	42,163	42,170	42,178	42,185	42,192
York	32,293	32,324	32,354	32,372	32,406	32,442	32,479	32,519	32,560	32,605	32,650

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:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Beaufort	17,213	17,224	17,236	17,238	17,257 (3,451) [828] {414}	17,277 (3,455) [829] {415}	17,298 (3,460) [830] {415}
Charleston	44,155	44,188	44,220	44,236	44,304 (8,861) [2,127] {1,063}	44,384 (8,877) [2,130] {1,065}	44,475 (8,895) [2,135] {1,067}
Greenville	75,775	75,795	75,815	75,836	75,865 (15,173) [3,642] {1,821}	75,894 (15,179) [3,643] {1,821}	75,924 (15,185) [3,644] {1,822}
Kershaw	7,583	7,592	7,601	7,603	7,613 (1,523) [365] {183}	7,625 (1,525) [366] {183}	7,639 (1,528) [367] {183}
Lexington	33,956	34,004	34,051	34,072	34,166 (6,833) [1,640] {820}	34,278 (6,856) [1,645] {823}	34,412 (6,882) [1,652] {826}
Richland	47,969	48,006	48,044	48,071	48,142 (9,628) [2,311] {1,155}	48,215 (9,643) [2,314] {1,157}	48,295 (9,659) [2,318] {1,159}
Spartanburg	42,117	42,121	42,126	42,142	42,156 (8,431) [2,023] {1,012}	42,170 (8,434) [2,024] {1,012}	42,185 (8,437) [2,025] {1,012}
York	32,293	32,324	32,354	32,372	32,442 (6,488) [1,557] {779}	32,519 (6,504) [1,561] {780}	32,605 (6,521) [1,565] {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.