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

Date: 5/4/21

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 5/4/21 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.

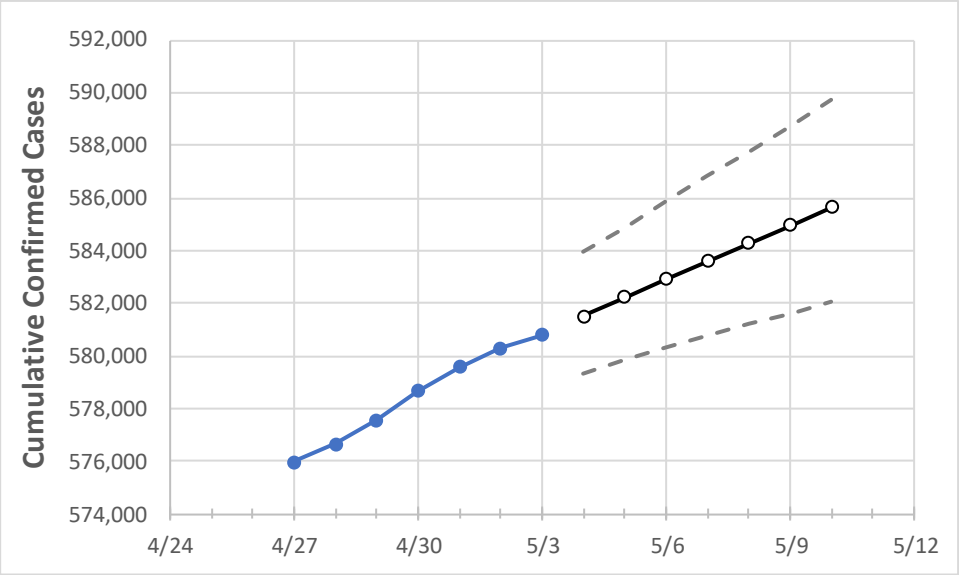
IEM's Modeling Lead

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
South Carolina	578,659	579,556	580,273	580,794	581,515	582,222	582,916	583,605	584,285	584,962	585,632

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
Beaufort	16,668	16,692	16,702	16,711	16,722	16,732	16,742	16,753	16,763	16,773	16,783
Charleston	42,727	42,785	42,841	42,882	42,936	42,988	43,040	43,091	43,140	43,190	43,239
Greenville	73,496	73,561	73,669	73,752	73,833	73,911	73,989	74,064	74,136	74,209	74,280
Kershaw	7,403	7,415	7,428	7,437	7,448	7,460	7,472	7,484	7,496	7,508	7,521
Lexington	32,992	33,028	33,060	33,081	33,111	33,139	33,167	33,195	33,222	33,248	33,275
Richland	45,937	46,053	46,113	46,166	46,226	46,286	46,344	46,402	46,461	46,518	46,576
Spartanburg	40,791	40,824	40,888	40,911	40,951	40,988	41,027	41,064	41,101	41,137	41,173
York	30,574	30,720	30,774	30,823	30,888	30,950	31,015	31,080	31,144	31,209	31,272

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:		
	4/30	5/1	5/2	5/3	5/5	5/7	5/9
Beaufort	16,668	16,692	16,702	16,711	16,732 (3,346) [803] {402}	16,753 (3,351) [804] {402}	16,773 (3,355) [805] {403}
Charleston	42,727	42,785	42,841	42,882	42,988 (8,598) [2,063] {1,032}	43,091 (8,618) [2,068] {1,034}	43,190 (8,638) [2,073] {1,037}
Greenville	73,496	73,561	73,669	73,752	73,911 (14,782) [3,548] {1,774}	74,064 (14,813) [3,555] {1,778}	74,209 (14,842) [3,562] {1,781}
Kershaw	7,403	7,415	7,428	7,437	7,460 (1,492) [358] {179}	7,484 (1,497) [359] {180}	7,508 (1,502) [360] {180}
Lexington	32,992	33,028	33,060	33,081	33,139 (6,628) [1,591] {795}	33,195 (6,639) [1,593] {797}	33,248 (6,650) [1,596] {798}
Richland	45,937	46,053	46,113	46,166	46,286 (9,257) [2,222] {1,111}	46,402 (9,280) [2,227] {1,114}	46,518 (9,304) [2,233] {1,116}
Spartanburg	40,791	40,824	40,888	40,911	40,988 (8,198) [1,967] {984}	41,064 (8,213) [1,971] {986}	41,137 (8,227) [1,975] {987}
York	30,574	30,720	30,774	30,823	30,950 (6,190) [1,486] {743}	31,080 (6,216) [1,492] {746}	31,209 (6,242) [1,498] {749}

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.