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

Date: 8/11/21

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 8/11/21 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.

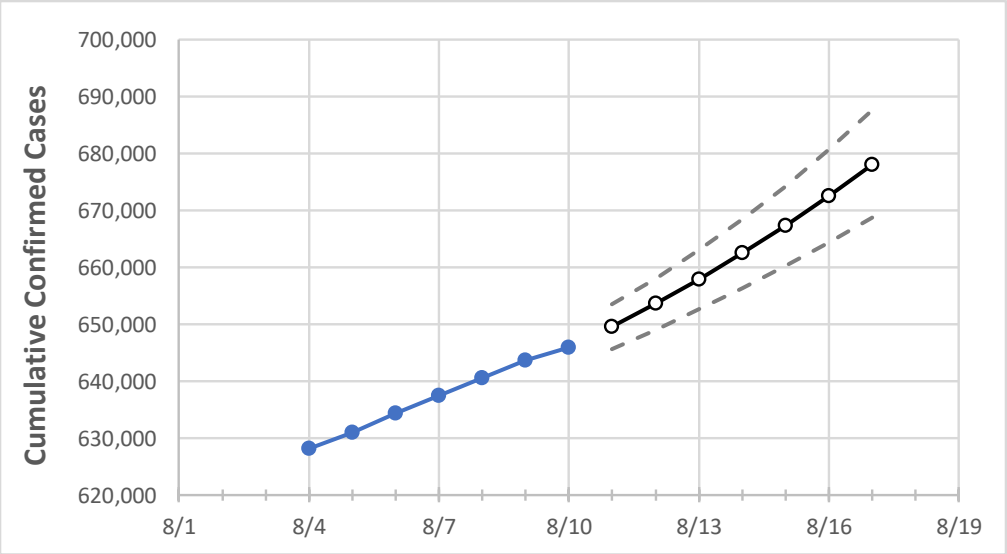
IEM's Modeling Lead

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
South Carolina	637,414	640,517	643,621	645,859	649,611	653,642	657,911	662,503	667,370	672,555	678,005

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Beaufort	18,907	19,076	19,244	19,363	19,562	19,780	20,014	20,266	20,537	20,833	21,154
Charleston	47,376	47,672	47,967	48,104	48,452	48,833	49,235	49,676	50,147	50,657	51,197
Greenville	78,698	78,964	79,229	79,436	79,744	80,071	80,425	80,802	81,205	81,634	82,094
Kershaw	8,304	8,372	8,441	8,480	8,549	8,622	8,699	8,780	8,866	8,956	9,054
Lexington	37,099	37,355	37,612	37,775	38,078	38,396	38,739	39,100	39,488	39,899	40,338
Richland	51,489	51,763	52,038	52,207	52,560	52,933	53,325	53,748	54,189	54,657	55,158
Spartanburg	43,961	44,137	44,313	44,445	44,650	44,871	45,113	45,374	45,653	45,955	46,279
York	34,277	34,433	34,590	34,701	34,880	35,072	35,275	35,494	35,722	35,962	36,218

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:		
	8/7	8/8	8/9	8/10	8/12	8/14	8/16
Beaufort	18,907	19,076	19,244	19,363	19,780 (3,956) [949] {475}	20,266 (4,053) [973] {486}	20,833 (4,167) [1,000] {500}
Charleston	47,376	47,672	47,967	48,104	48,833 (9,767) [2,344] {1,172}	49,676 (9,935) [2,384] {1,192}	50,657 (10,131) [2,432] {1,216}
Greenville	78,698	78,964	79,229	79,436	80,071 (16,014) [3,843] {1,922}	80,802 (16,160) [3,879] {1,939}	81,634 (16,327) [3,918] {1,959}
Kershaw	8,304	8,372	8,441	8,480	8,622 (1,724) [414] {207}	8,780 (1,756) [421] {211}	8,956 (1,791) [430] {215}
Lexington	37,099	37,355	37,612	37,775	38,396 (7,679) [1,843] {922}	39,100 (7,820) [1,877] {938}	39,899 (7,980) [1,915] {958}
Richland	51,489	51,763	52,038	52,207	52,933 (10,587) [2,541] {1,270}	53,748 (10,750) [2,580] {1,290}	54,657 (10,931) [2,624] {1,312}
Spartanburg	43,961	44,137	44,313	44,445	44,871 (8,974) [2,154] {1,077}	45,374 (9,075) [2,178] {1,089}	45,955 (9,191) [2,206] {1,103}
York	34,277	34,433	34,590	34,701	35,072 (7,014) [1,683] {842}	35,494 (7,099) [1,704] {852}	35,962 (7,192) [1,726] {863}

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.