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

Date: 8/9/21

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 8/9/21 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.

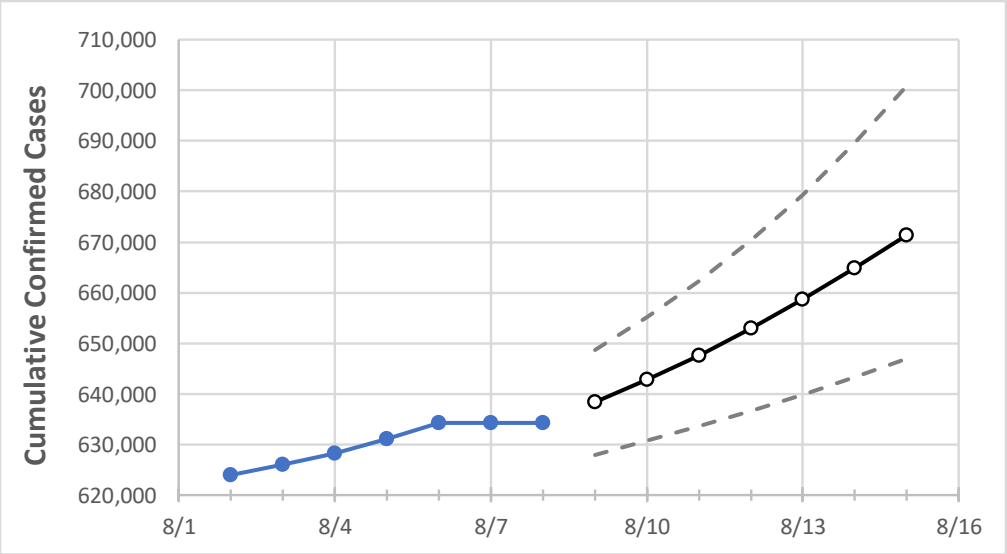
IEM's Modeling Lead

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:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
South Carolina	631,037	634,310	634,310	634,310	638,431	642,785	647,627	652,909	658,594	664,790	671,415

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:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
Beaufort	18,556	18,739	18,739	18,739	18,942	19,161	19,406	19,671	19,960	20,281	20,633
Charleston	46,882	47,081	47,081	47,081	47,448	47,852	48,295	48,784	49,331	49,920	50,570
Greenville	78,152	78,433	78,433	78,433	78,709	79,016	79,345	79,705	80,092	80,503	80,955
Kershaw	8,189	8,235	8,235	8,235	8,292	8,352	8,417	8,486	8,560	8,637	8,720
Lexington	36,565	36,842	36,842	36,842	37,154	37,492	37,855	38,251	38,677	39,140	39,626
Richland	50,972	51,214	51,214	51,214	51,563	51,941	52,351	52,797	53,278	53,793	54,361
Spartanburg	43,648	43,785	43,785	43,785	43,975	44,175	44,403	44,651	44,917	45,221	45,537
York	33,967	34,120	34,120	34,120	34,302	34,499	34,710	34,934	35,180	35,446	35,729

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:		
	8/5	8/6	8/7	8/8	8/10	8/12	8/14
Beaufort	18,556	18,739	18,739	18,739	19,161 (3,832) [920] {460}	19,671 (3,934) [944] {472}	20,281 (4,056) [973] {487}
Charleston	46,882	47,081	47,081	47,081	47,852 (9,570) [2,297] {1,148}	48,784 (9,757) [2,342] {1,171}	49,920 (9,984) [2,396] {1,198}
Greenville	78,152	78,433	78,433	78,433	79,016 (15,803) [3,793] {1,896}	79,705 (15,941) [3,826] {1,913}	80,503 (16,101) [3,864] {1,932}
Kershaw	8,189	8,235	8,235	8,235	8,352 (1,670) [401] {200}	8,486 (1,697) [407] {204}	8,637 (1,727) [415] {207}
Lexington	36,565	36,842	36,842	36,842	37,492 (7,498) [1,800] {900}	38,251 (7,650) [1,836] {918}	39,140 (7,828) [1,879] {939}
Richland	50,972	51,214	51,214	51,214	51,941 (10,388) [2,493] {1,247}	52,797 (10,559) [2,534] {1,267}	53,793 (10,759) [2,582] {1,291}
Spartanburg	43,648	43,785	43,785	43,785	44,175 (8,835) [2,120] {1,060}	44,651 (8,930) [2,143] {1,072}	45,221 (9,044) [2,171] {1,085}
York	33,967	34,120	34,120	34,120	34,499 (6,900) [1,656] {828}	34,934 (6,987) [1,677] {838}	35,446 (7,089) [1,701] {851}

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.