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

Date: 8/30/21

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 <u>not</u> 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 8/30/21 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.

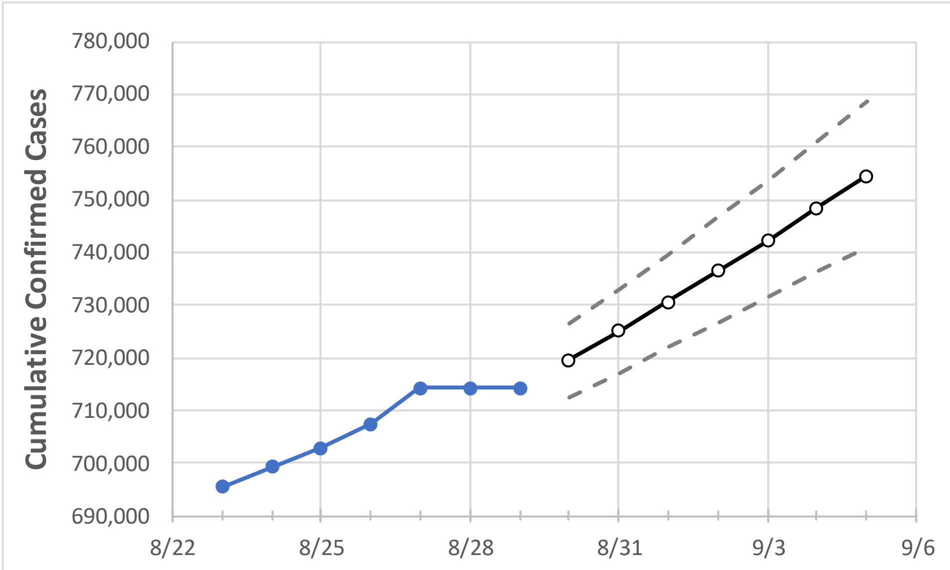
IEM's Modeling Lead

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:						
	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5
South Carolina	707,435	714,265	714,265	714,265	719,646	725,065	730,639	736,407	742,228	748,371	754,570

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:						
	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5
Beaufort	22,234	22,385	22,385	22,385	22,573	22,767	22,959	23,159	23,353	23,558	23,751
Charleston	53,528	54,132	54,132	54,132	54,583	55,049	55,516	55,998	56,493	57,009	57,517
Greenville	84,612	85,211	85,211	85,211	85,690	86,183	86,688	87,209	87,755	88,300	88,887
Kershaw	9,463	9,549	9,549	9,549	9,614	9,679	9,747	9,811	9,879	9,948	10,015
Lexington	42,448	43,010	43,010	43,010	43,404	43,803	44,219	44,633	45,071	45,513	45,953
Richland	56,524	57,006	57,006	57,006	57,325	57,646	57,963	58,301	58,636	58,964	59,313
Spartanburg	47,677	48,037	48,037	48,037	48,309	48,591	48,876	49,170	49,475	49,788	50,090
York	37,074	37,387	37,387	37,387	37,583	37,786	37,990	38,199	38,414	38,627	38,845

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:		
	8/26	8/27	8/28	8/29	8/31	9/2	9/4
Beaufort	22,234	22,385	22,385	22,385	22,767 (4,553) [1,093] {546}	23,159 (4,632) [1,112] {556}	23,558 (4,712) [1,131] {565}
Charleston	53,528	54,132	54,132	54,132	55,049 (11,010) [2,642] {1,321}	55,998 (11,200) [2,688] {1,344}	57,009 (11,402) [2,736] {1,368}
Greenville	84,612	85,211	85,211	85,211	86,183 (17,237) [4,137] {2,068}	87,209 (17,442) [4,186] {2,093}	88,300 (17,660) [4,238] {2,119}
Kershaw	9,463	9,549	9,549	9,549	9,679 (1,936) [465] {232}	9,811 (1,962) [471] {235}	9,948 (1,990) [477] {239}
Lexington	42,448	43,010	43,010	43,010	43,803 (8,761) [2,103] {1,051}	44,633 (8,927) [2,142] {1,071}	45,513 (9,103) [2,185] {1,092}
Richland	56,524	57,006	57,006	57,006	57,646 (11,529) [2,767] {1,384}	58,301 (11,660) [2,798] {1,399}	58,964 (11,793) [2,830] {1,415}
Spartanburg	47,677	48,037	48,037	48,037	48,591 (9,718) [2,332] {1,166}	49,170 (9,834) [2,360] {1,180}	49,788 (9,958) [2,390] {1,195}
York	37,074	37,387	37,387	37,387	37,786 (7,557) [1,814] {907}	38,199 (7,640) [1,834] {917}	38,627 (7,725) [1,854] {927}

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.