IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/1/21

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 9/1/21 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
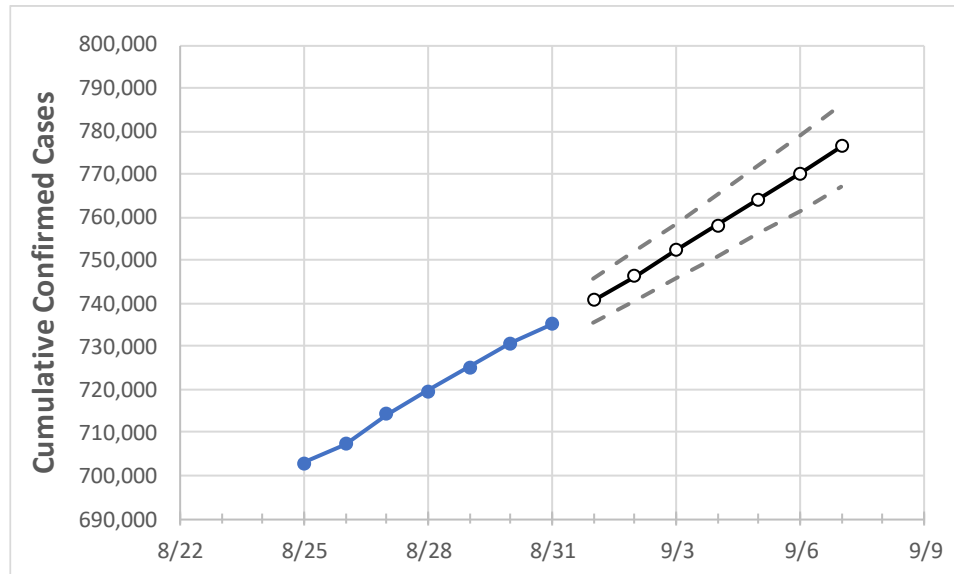
	Actual Confirmed Cases On:				Projected Cases For:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
South Carolina	719,738	725,212	730,685	735,287	740,797	746,436	752,242	758,071	764,109	770,340	776,467

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Beaufort	22,561	22,736	22,912	23,077	23,257	23,442	23,627	23,813	24,000	24,189	24,380
Charleston	54,520	54,909	55,297	55,647	56,075	56,517	56,955	57,404	57,867	58,334	58,801
Greenville	85,734	86,256	86,779	87,177	87,697	88,228	88,774	89,328	89,906	90,509	91,118
Kershaw	9,623	9,698	9,772	9,812	9,880	9,945	10,012	10,079	10,146	10,215	10,283
Lexington	43,386	43,761	44,137	44,419	44,812	45,208	45,604	46,016	46,425	46,857	47,288
Richland	57,332	57,659	57,985	58,184	58,503	58,825	59,146	59,475	59,801	60,141	60,475
Spartanburg	48,430	48,822	49,215	49,478	49,818	50,162	50,520	50,889	51,264	51,651	52,060
York	37,675	37,963	38,251	38,473	38,729	38,984	39,250	39,527	39,805	40,101	40,393

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:		
	8/28	8/29	8/30	8/31	9/2	9/4	9/6
Beaufort	22,561	22,736	22,912	23,077	23,442 (4,688) [1,125] {563}	23,813 (4,763) [1,143] {572}	24,189 (4,838) [1,161] {581}
Charleston	54,520	54,909	55,297	55,647	56,517 (11,303) [2,713] {1,356}	57,404 (11,481) [2,755] {1,378}	58,334 (11,667) [2,800] {1,400}
Greenville	85,734	86,256	86,779	87,177	88,228 (17,646) [4,235] {2,117}	89,328 (17,866) [4,288] {2,144}	90,509 (18,102) [4,344] {2,172}
Kershaw	9,623	9,698	9,772	9,812	9,945 (1,989) [477] {239}	10,079 (2,016) [484] {242}	10,215 (2,043) [490] {245}
Lexington	43,386	43,761	44,137	44,419	45,208 (9,042) [2,170] {1,085}	46,016 (9,203) [2,209] {1,104}	46,857 (9,371) [2,249] {1,125}
Richland	57,332	57,659	57,985	58,184	58,825 (11,765) [2,824] {1,412}	59,475 (11,895) [2,855] {1,427}	60,141 (12,028) [2,887] {1,443}
Spartanburg	48,430	48,822	49,215	49,478	50,162 (10,032) [2,408] {1,204}	50,889 (10,178) [2,443] {1,221}	51,651 (10,330) [2,479] {1,240}
York	37,675	37,963	38,251	38,473	38,984 (7,797) [1,871] {936}	39,527 (7,905) [1,897] {949}	40,101 (8,020) [1,925] {962}

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.