IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/27/21

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 8/27/21 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
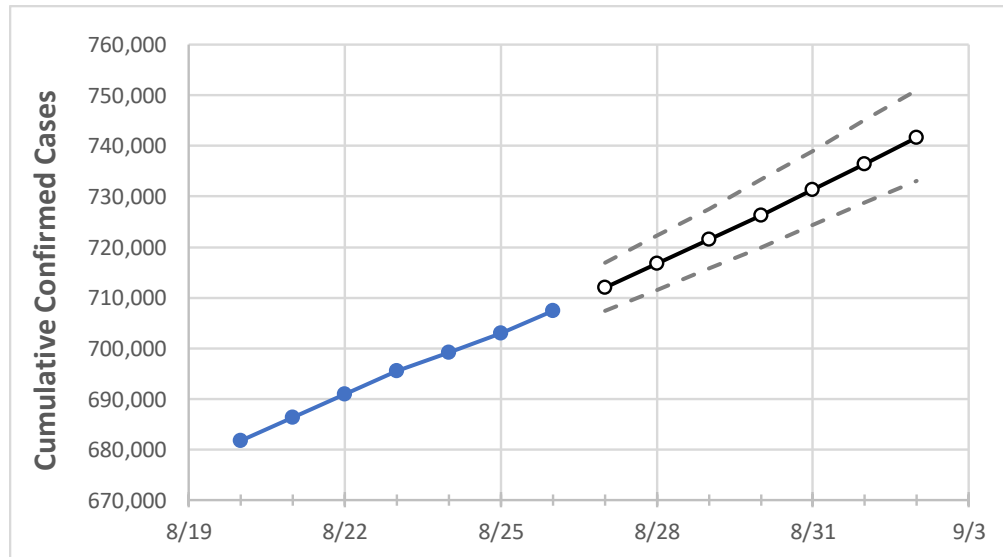
	Actual Confirmed Cases On:				Projected Cases For:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
South Carolina	695,489	699,197	702,894	707,435	712,062	716,722	721,459	726,333	731,408	736,433	741,689

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:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
Beaufort	21,742	21,897	22,061	22,234	22,430	22,621	22,819	23,019	23,220	23,428	23,633
Charleston	52,465	52,814	53,131	53,528	53,916	54,304	54,705	55,114	55,526	55,946	56,391
Greenville	83,571	83,927	84,230	84,612	85,024	85,452	85,882	86,338	86,790	87,265	87,749
Kershaw	9,324	9,365	9,399	9,463	9,525	9,587	9,648	9,709	9,771	9,835	9,897
Lexington	41,549	41,838	42,111	42,448	42,784	43,122	43,467	43,818	44,173	44,532	44,902
Richland	55,796	56,022	56,223	56,524	56,813	57,086	57,376	57,661	57,951	58,248	58,540
Spartanburg	47,064	47,252	47,475	47,677	47,914	48,158	48,404	48,659	48,909	49,175	49,441
York	36,606	36,733	36,890	37,074	37,240	37,410	37,578	37,753	37,927	38,107	38,285

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:		
	8/23	8/24	8/25	8/26	8/28	8/30	9/1
Beaufort	21,742	21,897	22,061	22,234	22,621 (4,524) [1,086] {543}	23,019 (4,604) [1,105] {552}	23,428 (4,686) [1,125] {562}
Charleston	52,465	52,814	53,131	53,528	54,304 (10,861) [2,607] {1,303}	55,114 (11,023) [2,645] {1,323}	55,946 (11,189) [2,685] {1,343}
Greenville	83,571	83,927	84,230	84,612	85,452 (17,090) [4,102] {2,051}	86,338 (17,268) [4,144] {2,072}	87,265 (17,453) [4,189] {2,094}
Kershaw	9,324	9,365	9,399	9,463	9,587 (1,917) [460] {230}	9,709 (1,942) [466] {233}	9,835 (1,967) [472] {236}
Lexington	41,549	41,838	42,111	42,448	43,122 (8,624) [2,070] {1,035}	43,818 (8,764) [2,103] {1,052}	44,532 (8,906) [2,138] {1,069}
Richland	55,796	56,022	56,223	56,524	57,086 (11,417) [2,740] {1,370}	57,661 (11,532) [2,768] {1,384}	58,248 (11,650) [2,796] {1,398}
Spartanburg	47,064	47,252	47,475	47,677	48,158 (9,632) [2,312] {1,156}	48,659 (9,732) [2,336] {1,168}	49,175 (9,835) [2,360] {1,180}
York	36,606	36,733	36,890	37,074	37,410 (7,482) [1,796] {898}	37,753 (7,551) [1,812] {906}	38,107 (7,621) [1,829] {915}

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.