IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/22/21

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 2/22/21 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
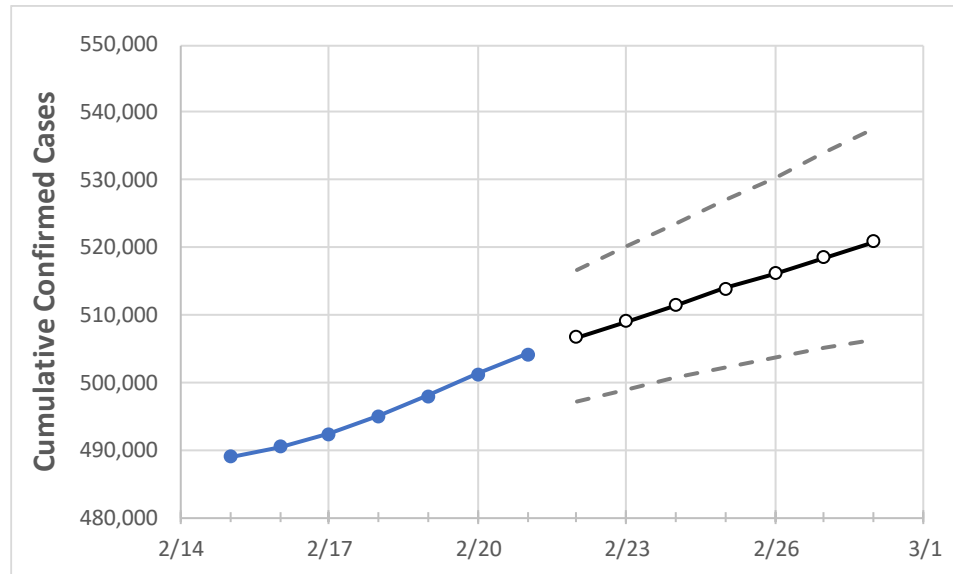
	Actual Confirmed Cases On:				Projected Cases For:						
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28
South Carolina	495,044	497,937	501,277	504,149	506,631	509,067	511,478	513,876	516,206	518,520	520,817

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:						
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28
Beaufort	14,841	14,902	15,004	15,078	15,133	15,186	15,238	15,288	15,339	15,388	15,437
Charleston	36,808	36,983	37,161	37,332	37,507	37,682	37,848	38,011	38,167	38,320	38,471
Greenville	61,690	62,014	62,248	62,535	62,760	62,980	63,200	63,411	63,611	63,807	63,993
Kershaw	6,337	6,394	6,443	6,505	6,548	6,591	6,633	6,675	6,717	6,759	6,800
Lexington	28,151	28,412	28,730	29,020	29,255	29,496	29,737	29,984	30,231	30,483	30,736
Richland	39,434	39,694	40,046	40,371	40,596	40,822	41,052	41,279	41,510	41,746	41,982
Spartanburg	34,279	34,437	34,678	34,925	35,095	35,261	35,421	35,577	35,735	35,892	36,041
York	24,923	25,119	25,375	25,572	25,734	25,894	26,057	26,223	26,386	26,547	26,712

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:		
	2/18	2/19	2/20	2/21	2/23	2/25	2/27
Beaufort	14,841	14,902	15,004	15,078	15,186 (3,037) [729] {364}	15,288 (3,058) [734] {367}	15,388 (3,078) [739] {369}
Charleston	36,808	36,983	37,161	37,332	37,682 (7,536) [1,809] {904}	38,011 (7,602) [1,825] {912}	38,320 (7,664) [1,839] {920}
Greenville	61,690	62,014	62,248	62,535	62,980 (12,596) [3,023] {1,512}	63,411 (12,682) [3,044] {1,522}	63,807 (12,761) [3,063] {1,531}
Kershaw	6,337	6,394	6,443	6,505	6,591 (1,318) [316] {158}	6,675 (1,335) [320] {160}	6,759 (1,352) [324] {162}
Lexington	28,151	28,412	28,730	29,020	29,496 (5,899) [1,416] {708}	29,984 (5,997) [1,439] {720}	30,483 (6,097) [1,463] {732}
Richland	39,434	39,694	40,046	40,371	40,822 (8,164) [1,959] {980}	41,279 (8,256) [1,981] {991}	41,746 (8,349) [2,004] {1,002}
Spartanburg	34,279	34,437	34,678	34,925	35,261 (7,052) [1,693] {846}	35,577 (7,115) [1,708] {854}	35,892 (7,178) [1,723] {861}
York	24,923	25,119	25,375	25,572	25,894 (5,179) [1,243] {621}	26,223 (5,245) [1,259] {629}	26,547 (5,309) [1,274] {637}

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.