IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/3/21

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 12/3/21 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
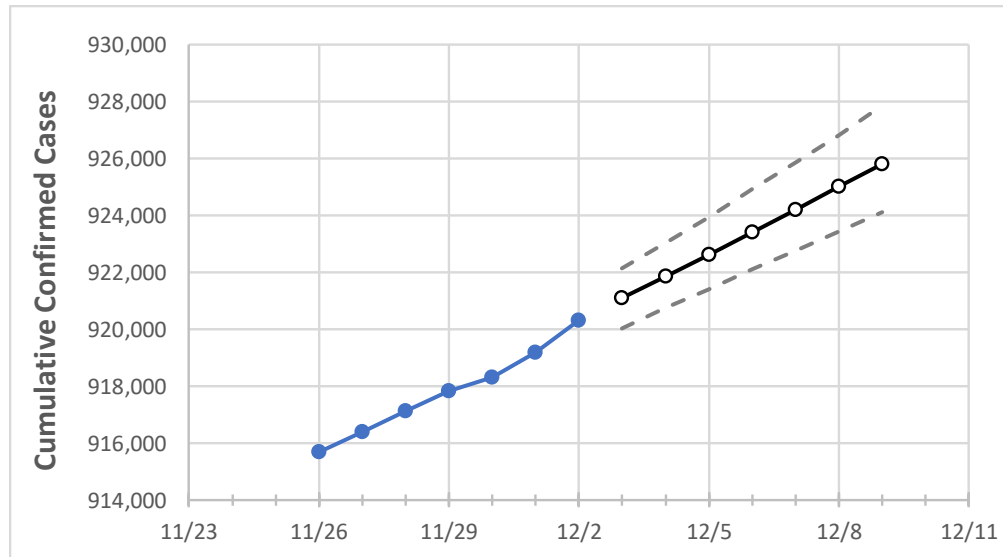
	Actual Confirmed Cases On:				Projected Cases For:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
South Carolina	917,833	918,321	919,184	920,311	921,090	921,847	922,631	923,405	924,212	925,010	925,813

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Beaufort	27,637	27,641	27,668	27,693	27,706	27,720	27,734	27,747	27,761	27,775	27,789
Charleston	66,616	66,650	66,717	66,802	66,854	66,905	66,958	67,012	67,063	67,121	67,173
Greenville	107,669	107,730	107,810	107,942	108,024	108,108	108,188	108,271	108,353	108,437	108,519
Kershaw	12,238	12,256	12,276	12,295	12,306	12,317	12,327	12,339	12,349	12,360	12,372
Lexington	55,483	55,512	55,564	55,638	55,692	55,746	55,800	55,856	55,912	55,970	56,028
Richland	70,200	70,222	70,268	70,359	70,400	70,440	70,478	70,519	70,559	70,599	70,641
Spartanburg	63,146	63,178	63,263	63,308	63,354	63,400	63,446	63,492	63,539	63,585	63,633
York	48,178	48,219	48,290	48,358	48,411	48,464	48,517	48,572	48,627	48,684	48,738

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: | | |
	11/29	11/30	12/1	12/2	12/4	12/6	12/8
Beaufort	27,637	27,641	27,668	27,693	27,720 (5,544) [1,331] {665}	27,747 (5,549) [1,332] {666}	27,775 (5,555) [1,333] {667}
Charleston	66,616	66,650	66,717	66,802	66,905 (13,381) [3,211] {1,606}	67,012 (13,402) [3,217] {1,608}	67,121 (13,424) [3,222] {1,611}
Greenville	107,669	107,730	107,810	107,942	108,108 (21,622) [5,189] {2,595}	108,271 (21,654) [5,197] {2,599}	108,437 (21,687) [5,205] {2,602}
Kershaw	12,238	12,256	12,276	12,295	12,317 (2,463) [591] {296}	12,339 (2,468) [592] {296}	12,360 (2,472) [593] {297}
Lexington	55,483	55,512	55,564	55,638	55,746 (11,149) [2,676] {1,338}	55,856 (11,171) [2,681] {1,341}	55,970 (11,194) [2,687] {1,343}
Richland	70,200	70,222	70,268	70,359	70,440 (14,088) [3,381] {1,691}	70,519 (14,104) [3,385] {1,692}	70,599 (14,120) [3,389] {1,694}
Spartanburg	63,146	63,178	63,263	63,308	63,400 (12,680) [3,043] {1,522}	63,492 (12,698) [3,048] {1,524}	63,585 (12,717) [3,052] {1,526}
York	48,178	48,219	48,290	48,358	48,464 (9,693) [2,326] {1,163}	48,572 (9,714) [2,331] {1,166}	48,684 (9,737) [2,337] {1,168}

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.