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

Date: 12/29/20

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 not 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 12/29/20 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.

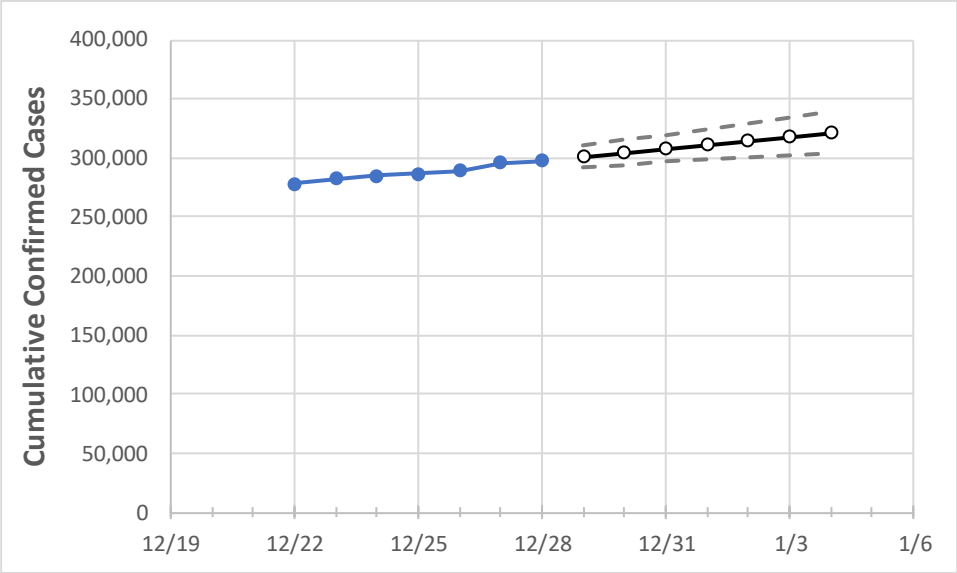
IEM's Modeling Lead

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:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
South Carolina	286,960	288,892	296,179	298,050	301,303	304,527	307,786	311,105	314,403	317,756	321,166

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 20%, and are often within 10%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Beaufort	9,000	9,051	9,223	9,266	9,354	9,443	9,533	9,625	9,713	9,804	9,898
Charleston	23,125	23,221	23,511	23,598	23,729	23,858	23,989	24,121	24,254	24,389	24,524
Greenville	34,238	34,541	35,719	35,987	36,498	37,019	37,543	38,078	38,642	39,206	39,764
Kershaw	3,679	3,705	3,762	3,778	3,807	3,838	3,869	3,900	3,931	3,961	3,995
Lexington	15,372	15,478	15,961	16,051	16,257	16,466	16,674	16,884	17,098	17,322	17,544
Richland	25,088	25,200	25,583	25,695	25,873	26,047	26,227	26,411	26,591	26,762	26,944
Spartanburg	18,360	18,477	19,121	19,283	19,553	19,831	20,115	20,401	20,688	20,981	21,290
York	14,146	14,279	14,613	14,692	14,857	15,029	15,199	15,363	15,528	15,696	15,861

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:		
	12/25	12/26	12/27	12/28	12/30	1/1	1/3
Beaufort	9,000	9,051	9,223	9,266	9,443 (1,889) [453] {227}	9,625 (1,925) [462] {231}	9,804 (1,961) [471] {235}
Charleston	23,125	23,221	23,511	23,598	23,858 (4,772) [1,145] {573}	24,121 (4,824) [1,158] {579}	24,389 (4,878) [1,171] {585}
Greenville	34,238	34,541	35,719	35,987	37,019 (7,404) [1,777] {888}	38,078 (7,616) [1,828] {914}	39,206 (7,841) [1,882] {941}
Kershaw	3,679	3,705	3,762	3,778	3,838 (768) [184] {92}	3,900 (780) [187] {94}	3,961 (792) [190] {95}
Lexington	15,372	15,478	15,961	16,051	16,466 (3,293) [790] {395}	16,884 (3,377) [810] {405}	17,322 (3,464) [831] {416}
Richland	25,088	25,200	25,583	25,695	26,047 (5,209) [1,250] {625}	26,411 (5,282) [1,268] {634}	26,762 (5,352) [1,285] {642}
Spartanburg	18,360	18,477	19,121	19,283	19,831 (3,966) [952] {476}	20,401 (4,080) [979] {490}	20,981 (4,196) [1,007] {504}
York	14,146	14,279	14,613	14,692	15,029 (3,006) [721] {361}	15,363 (3,073) [737] {369}	15,696 (3,139) [753] {377}

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.