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

Date: 12/2/20

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 12/2/20 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.

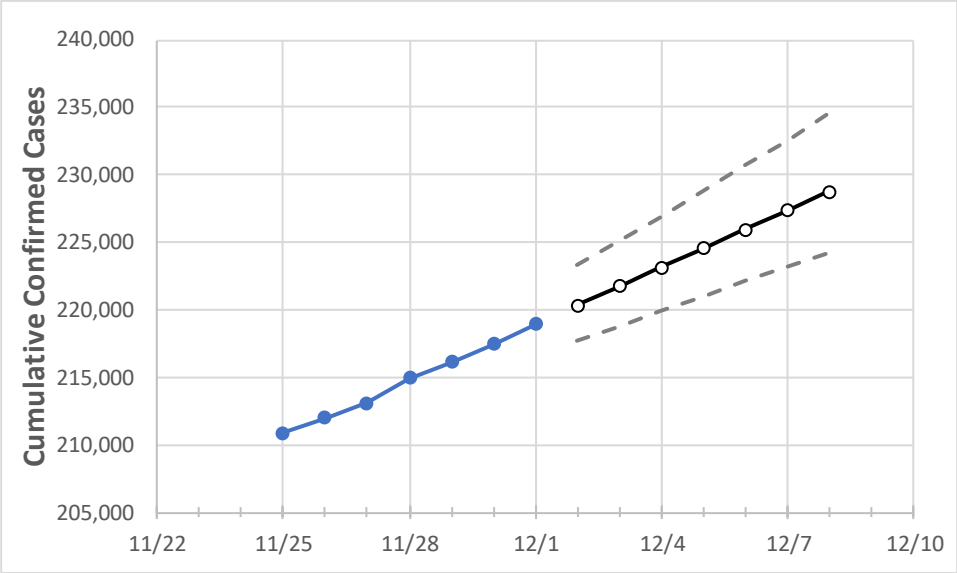
IEM's Modeling Lead

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:						
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8
South Carolina	214,911	216,129	217,487	218,912	220,334	221,751	223,163	224,570	225,973	227,371	228,766

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:						
	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8
Beaufort	7,096	7,126	7,139	7,195	7,229	7,263	7,297	7,332	7,367	7,402	7,437
Charleston	19,863	19,927	19,992	20,052	20,135	20,218	20,300	20,381	20,462	20,542	20,621
Greenville	23,609	23,785	23,973	24,219	24,430	24,642	24,855	25,068	25,282	25,497	25,712
Kershaw	2,935	2,953	2,966	2,975	2,988	3,000	3,013	3,025	3,038	3,051	3,064
Lexington	11,275	11,357	11,454	11,516	11,585	11,654	11,723	11,793	11,862	11,931	12,000
Richland	20,241	20,347	20,446	20,535	20,629	20,723	20,816	20,908	21,000	21,091	21,182
Spartanburg	12,291	12,414	12,496	12,628	12,749	12,872	12,995	13,119	13,244	13,370	13,497
York	9,585	9,670	9,791	9,926	10,034	10,142	10,251	10,361	10,471	10,583	10,694

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:		
	11/28	11/29	11/30	12/1	12/3	12/5	12/7
Beaufort	7,096	7,126	7,139	7,195	7,263 (1,453) [349] {174}	7,332 (1,466) [352] {176}	7,402 (1,480) [355] {178}
Charleston	19,863	19,927	19,992	20,052	20,218 (4,044) [970] {485}	20,381 (4,076) [978] {489}	20,542 (4,108) [986] {493}
Greenville	23,609	23,785	23,973	24,219	24,642 (4,928) [1,183] {591}	25,068 (5,014) [1,203] {602}	25,497 (5,099) [1,224] {612}
Kershaw	2,935	2,953	2,966	2,975	3,000 (600) [144] {72}	3,025 (605) [145] {73}	3,051 (610) [146] {73}
Lexington	11,275	11,357	11,454	11,516	11,654 (2,331) [559] {280}	11,793 (2,359) [566] {283}	11,931 (2,386) [573] {286}
Richland	20,241	20,347	20,446	20,535	20,723 (4,145) [995] {497}	20,908 (4,182) [1,004] {502}	21,091 (4,218) [1,012] {506}
Spartanburg	12,291	12,414	12,496	12,628	12,872 (2,574) [618] {309}	13,119 (2,624) [630] {315}	13,370 (2,674) [642] {321}
York	9,585	9,670	9,791	9,926	10,142 (2,028) [487] {243}	10,361 (2,072) [497] {249}	10,583 (2,117) [508] {254}

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.