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

Date: 11/30/20

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 11/30/20 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.

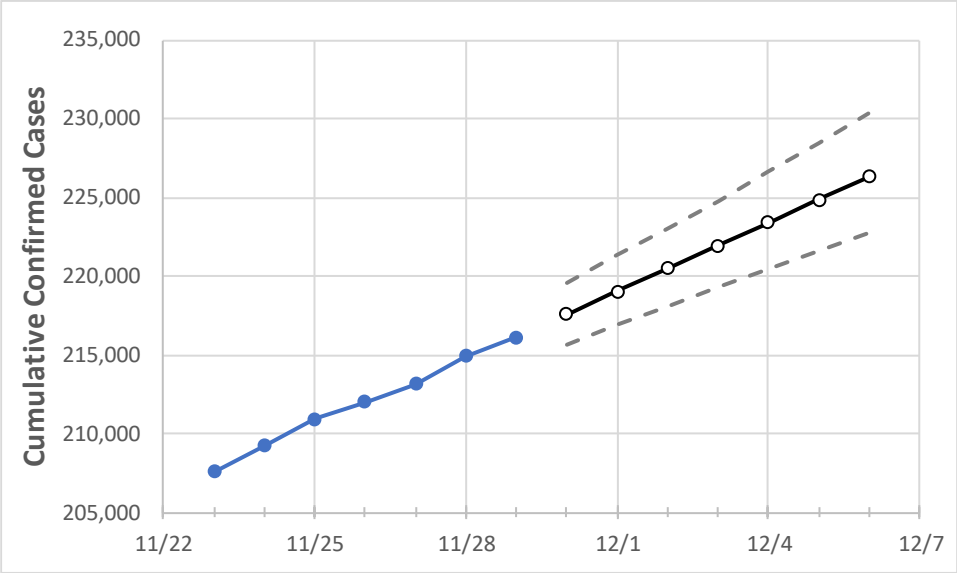
IEM's Modeling Lead

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:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
South Carolina	212,013	213,120	214,911	216,129	217,584	219,041	220,497	221,955	223,413	224,871	226,331

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:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
Beaufort	7,020	7,043	7,096	7,126	7,164	7,202	7,240	7,279	7,318	7,358	7,399
Charleston	19,697	19,803	19,863	19,927	20,023	20,119	20,216	20,313	20,411	20,509	20,607
Greenville	23,093	23,236	23,609	23,785	23,994	24,203	24,412	24,622	24,831	25,041	25,251
Kershaw	2,918	2,927	2,935	2,953	2,967	2,981	2,995	3,009	3,024	3,039	3,054
Lexington	11,119	11,174	11,275	11,357	11,425	11,492	11,559	11,626	11,693	11,760	11,826
Richland	20,110	20,182	20,241	20,347	20,447	20,548	20,649	20,750	20,851	20,953	21,054
Spartanburg	12,046	12,141	12,291	12,414	12,544	12,676	12,810	12,948	13,087	13,230	13,376
York	9,422	9,481	9,585	9,670	9,773	9,876	9,978	10,081	10,185	10,288	10,391

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:		
	11/26	11/27	11/28	11/29	12/1	12/3	12/5
Beaufort	7,020	7,043	7,096	7,126	7,202 (1,440) [346] {173}	7,279 (1,456) [349] {175}	7,358 (1,472) [353] {177}
Charleston	19,697	19,803	19,863	19,927	20,119 (4,024) [966] {483}	20,313 (4,063) [975] {488}	20,509 (4,102) [984] {492}
Greenville	23,093	23,236	23,609	23,785	24,203 (4,841) [1,162] {581}	24,622 (4,924) [1,182] {591}	25,041 (5,008) [1,202] {601}
Kershaw	2,918	2,927	2,935	2,953	2,981 (596) [143] {72}	3,009 (602) [144] {72}	3,039 (608) [146] {73}
Lexington	11,119	11,174	11,275	11,357	11,492 (2,298) [552] {276}	11,626 (2,325) [558] {279}	11,760 (2,352) [564] {282}
Richland	20,110	20,182	20,241	20,347	20,548 (4,110) [986] {493}	20,750 (4,150) [996] {498}	20,953 (4,191) [1,006] {503}
Spartanburg	12,046	12,141	12,291	12,414	12,676 (2,535) [608] {304}	12,948 (2,590) [621] {311}	13,230 (2,646) [635] {318}
York	9,422	9,481	9,585	9,670	9,876 (1,975) [474] {237}	10,081 (2,016) [484] {242}	10,288 (2,058) [494] {247}

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.