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

Date: 2/18/21

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 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 2/18/21 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.

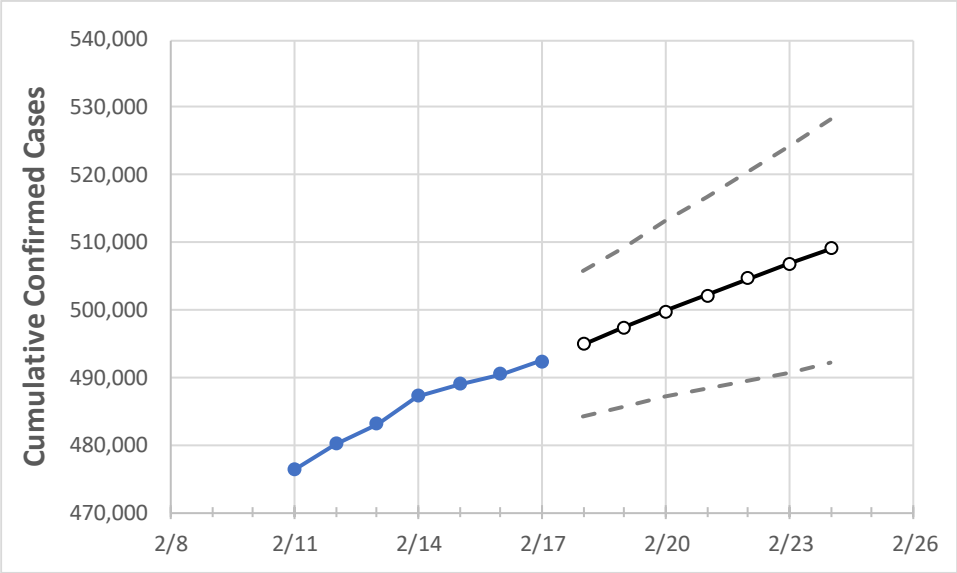
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
South Carolina	487,293	489,018	490,453	492,369	494,903	497,426	499,795	502,194	504,603	506,883	509,107

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Beaufort	14,659	14,690	14,736	14,771	14,821	14,869	14,913	14,957	15,000	15,039	15,078
Charleston	36,256	36,381	36,497	36,638	36,831	37,020	37,208	37,395	37,585	37,764	37,936
Greenville	60,996	61,130	61,269	61,421	61,661	61,899	62,124	62,354	62,568	62,791	62,998
Kershaw	6,210	6,251	6,270	6,308	6,347	6,385	6,424	6,462	6,500	6,536	6,572
Lexington	27,463	27,631	27,731	27,891	28,083	28,277	28,467	28,656	28,848	29,047	29,241
Richland	38,802	38,966	39,097	39,235	39,415	39,590	39,764	39,938	40,106	40,269	40,426
Spartanburg	33,740	33,841	33,932	34,085	34,275	34,461	34,640	34,812	34,982	35,152	35,311
York	24,484	24,594	24,668	24,782	24,920	25,055	25,191	25,322	25,451	25,582	25,711

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:		
	2/14	2/15	2/16	2/17	2/19	2/21	2/23
Beaufort	14,659	14,690	14,736	14,771	14,869 (2,974) [714] {357}	14,957 (2,991) [718] {359}	15,039 (3,008) [722] {361}
Charleston	36,256	36,381	36,497	36,638	37,020 (7,404) [1,777] {888}	37,395 (7,479) [1,795] {897}	37,764 (7,553) [1,813] {906}
Greenville	60,996	61,130	61,269	61,421	61,899 (12,380) [2,971] {1,486}	62,354 (12,471) [2,993] {1,496}	62,791 (12,558) [3,014] {1,507}
Kershaw	6,210	6,251	6,270	6,308	6,385 (1,277) [306] {153}	6,462 (1,292) [310] {155}	6,536 (1,307) [314] {157}
Lexington	27,463	27,631	27,731	27,891	28,277 (5,655) [1,357] {679}	28,656 (5,731) [1,375] {688}	29,047 (5,809) [1,394] {697}
Richland	38,802	38,966	39,097	39,235	39,590 (7,918) [1,900] {950}	39,938 (7,988) [1,917] {959}	40,269 (8,054) [1,933] {966}
Spartanburg	33,740	33,841	33,932	34,085	34,461 (6,892) [1,654] {827}	34,812 (6,962) [1,671] {835}	35,152 (7,030) [1,687] {844}
York	24,484	24,594	24,668	24,782	25,055 (5,011) [1,203] {601}	25,322 (5,064) [1,215] {608}	25,582 (5,116) [1,228] {614}

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.