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

Date: 2/24/21

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 2/24/21 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.

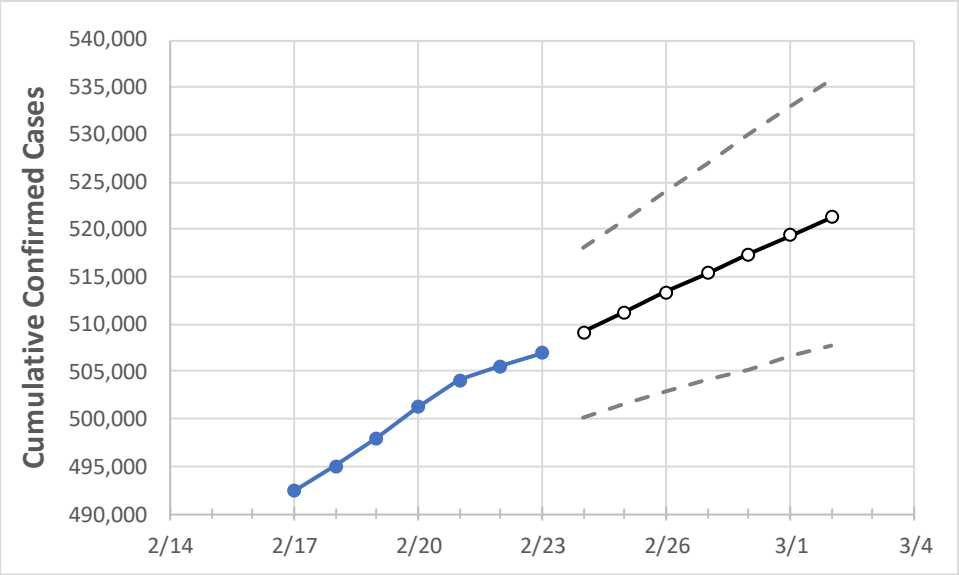
IEM's Modeling Lead

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
South Carolina	501,277	504,149	505,589	506,912	509,116	511,252	513,368	515,368	517,420	519,440	521,348

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Beaufort	15,004	15,078	15,112	15,141	15,187	15,232	15,275	15,316	15,358	15,395	15,436
Charleston	37,161	37,332	37,414	37,490	37,637	37,780	37,919	38,051	38,179	38,305	38,428
Greenville	62,248	62,535	62,644	62,770	62,968	63,162	63,357	63,536	63,713	63,884	64,053
Kershaw	6,443	6,505	6,536	6,587	6,630	6,673	6,716	6,760	6,803	6,845	6,887
Lexington	28,730	29,020	29,138	29,299	29,523	29,742	29,963	30,184	30,409	30,639	30,859
Richland	40,046	40,371	40,504	40,627	40,828	41,034	41,232	41,436	41,635	41,833	42,023
Spartanburg	34,678	34,925	35,028	35,116	35,268	35,418	35,562	35,698	35,833	35,964	36,092
York	25,375	25,572	25,686	25,797	25,945	26,093	26,239	26,381	26,526	26,672	26,814

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:		
	2/20	2/21	2/22	2/23	2/25	2/27	3/1
Beaufort	15,004	15,078	15,112	15,141	15,232 (3,046) [731] {366}	15,316 (3,063) [735] {368}	15,395 (3,079) [739] {369}
Charleston	37,161	37,332	37,414	37,490	37,780 (7,556) [1,813] {907}	38,051 (7,610) [1,826] {913}	38,305 (7,661) [1,839] {919}
Greenville	62,248	62,535	62,644	62,770	63,162 (12,632) [3,032] {1,516}	63,536 (12,707) [3,050] {1,525}	63,884 (12,777) [3,066] {1,533}
Kershaw	6,443	6,505	6,536	6,587	6,673 (1,335) [320] {160}	6,760 (1,352) [324] {162}	6,845 (1,369) [329] {164}
Lexington	28,730	29,020	29,138	29,299	29,742 (5,948) [1,428] {714}	30,184 (6,037) [1,449] {724}	30,639 (6,128) [1,471] {735}
Richland	40,046	40,371	40,504	40,627	41,034 (8,207) [1,970] {985}	41,436 (8,287) [1,989] {994}	41,833 (8,367) [2,008] {1,004}
Spartanburg	34,678	34,925	35,028	35,116	35,418 (7,084) [1,700] {850}	35,698 (7,140) [1,714] {857}	35,964 (7,193) [1,726] {863}
York	25,375	25,572	25,686	25,797	26,093 (5,219) [1,252] {626}	26,381 (5,276) [1,266] {633}	26,672 (5,334) [1,280] {640}

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.