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

Date: 1/28/22

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 1/28/22 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.

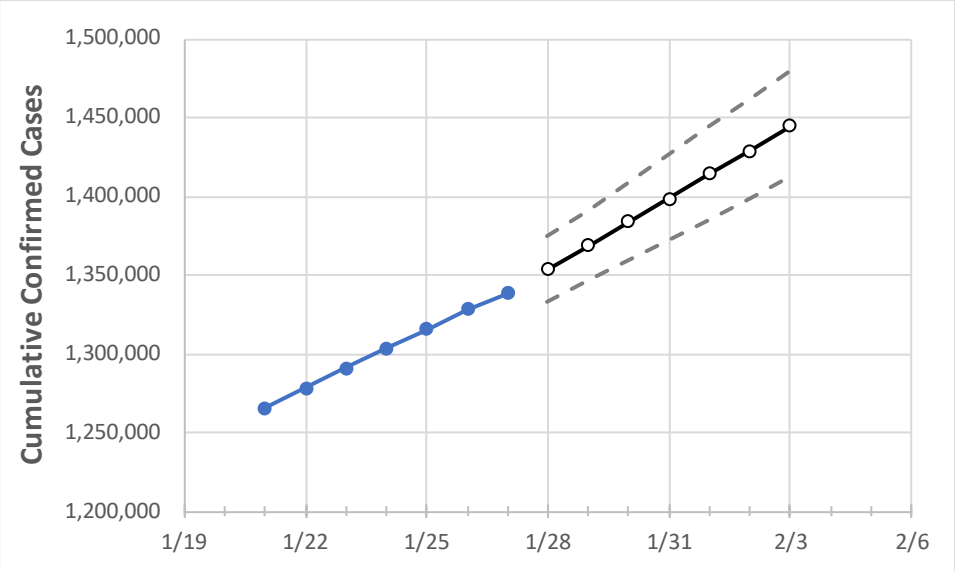
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
South Carolina	1,303,354	1,315,902	1,328,450	1,338,384	1,353,685	1,368,792	1,383,771	1,398,815	1,414,067	1,429,220	1,444,478

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Beaufort	37,891	38,207	38,523	38,708	39,115	39,516	39,898	40,286	40,700	41,098	41,492
Charleston	99,459	100,325	101,191	102,217	103,259	104,266	105,238	106,250	107,241	108,224	109,187
Greenville	154,175	155,619	157,063	158,094	160,112	161,960	163,889	165,862	167,748	169,711	171,695
Kershaw	18,435	18,656	18,877	19,012	19,247	19,484	19,717	19,959	20,192	20,432	20,666
Lexington	83,722	84,671	85,620	86,560	87,695	88,841	89,998	91,164	92,305	93,442	94,595
Richland	107,964	108,831	109,697	110,423	111,523	112,572	113,622	114,665	115,702	116,722	117,746
Spartanburg	85,549	86,364	87,180	87,762	88,761	89,767	90,766	91,781	92,798	93,818	94,836
York	68,330	69,013	69,696	70,055	70,809	71,576	72,326	73,079	73,844	74,616	75,382

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Beaufort	37,891	38,207	38,523	38,708	39,516 (7,903) [1,897] {948}	40,286 (8,057) [1,934] {967}	41,098 (8,220) [1,973] {986}
Charleston	99,459	100,325	101,191	102,217	104,266 (20,853) [5,005] {2,502}	106,250 (21,250) [5,100] {2,550}	108,224 (21,645) [5,195] {2,597}
Greenville	154,175	155,619	157,063	158,094	161,960 (32,392) [7,774] {3,887}	165,862 (33,172) [7,961] {3,981}	169,711 (33,942) [8,146] {4,073}
Kershaw	18,435	18,656	18,877	19,012	19,484 (3,897) [935] {468}	19,959 (3,992) [958] {479}	20,432 (4,086) [981] {490}
Lexington	83,722	84,671	85,620	86,560	88,841 (17,768) [4,264] {2,132}	91,164 (18,233) [4,376] {2,188}	93,442 (18,688) [4,485] {2,243}
Richland	107,964	108,831	109,697	110,423	112,572 (22,514) [5,403] {2,702}	114,665 (22,933) [5,504] {2,752}	116,722 (23,344) [5,603] {2,801}
Spartanburg	85,549	86,364	87,180	87,762	89,767 (17,953) [4,309] {2,154}	91,781 (18,356) [4,405] {2,203}	93,818 (18,764) [4,503] {2,252}
York	68,330	69,013	69,696	70,055	71,576 (14,315) [3,436] {1,718}	73,079 (14,616) [3,508] {1,754}	74,616 (14,923) [3,582] {1,791}

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.