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

Date: 1/29/21

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 1/29/21 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.

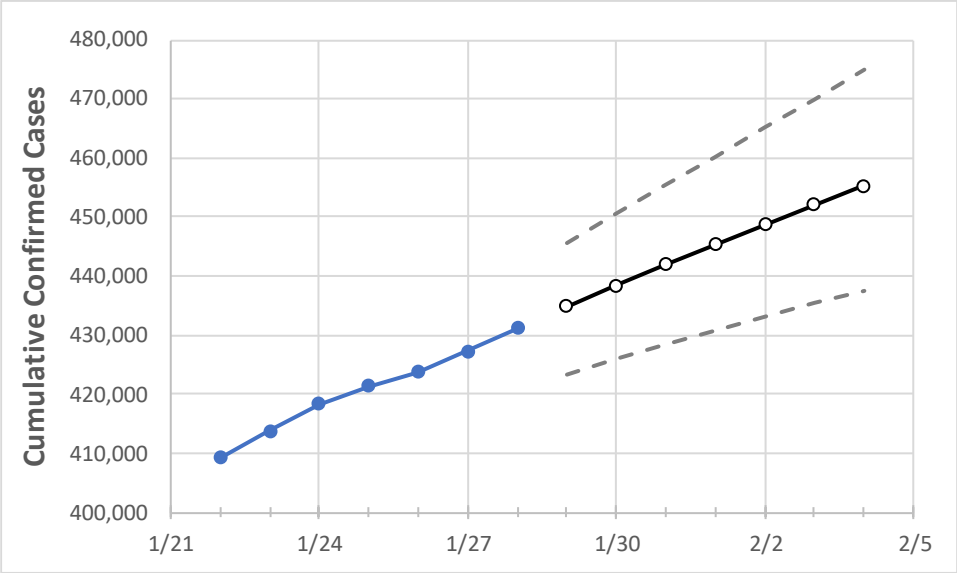
IEM's Modeling Lead

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:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
South Carolina	421,417	423,667	427,231	431,169	434,805	438,371	441,890	445,336	448,716	452,119	455,332

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:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
Beaufort	12,807	12,864	12,969	13,129	13,258	13,386	13,517	13,648	13,785	13,915	14,045
Charleston	31,170	31,288	31,520	31,844	32,093	32,345	32,598	32,843	33,089	33,329	33,573
Greenville	53,236	53,531	53,974	54,521	54,967	55,415	55,856	56,305	56,724	57,125	57,524
Kershaw	5,265	5,284	5,355	5,400	5,451	5,502	5,551	5,604	5,654	5,703	5,753
Lexington	23,455	23,594	23,783	23,941	24,105	24,263	24,413	24,556	24,695	24,828	24,956
Richland	34,167	34,331	34,653	34,928	35,198	35,474	35,745	36,041	36,325	36,602	36,879
Spartanburg	28,286	28,505	28,661	28,988	29,308	29,644	29,954	30,262	30,587	30,903	31,220
York	21,152	21,285	21,476	21,640	21,809	21,979	22,146	22,307	22,467	22,618	22,772

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:		
	1/25	1/26	1/27	1/28	1/30	2/1	2/3
Beaufort	12,807	12,864	12,969	13,129	13,386 (2,677) [643] {321}	13,648 (2,730) [655] {328}	13,915 (2,783) [668] {334}
Charleston	31,170	31,288	31,520	31,844	32,345 (6,469) [1,553] {776}	32,843 (6,569) [1,576] {788}	33,329 (6,666) [1,600] {800}
Greenville	53,236	53,531	53,974	54,521	55,415 (11,083) [2,660] {1,330}	56,305 (11,261) [2,703] {1,351}	57,125 (11,425) [2,742] {1,371}
Kershaw	5,265	5,284	5,355	5,400	5,502 (1,100) [264] {132}	5,604 (1,121) [269] {134}	5,703 (1,141) [274] {137}
Lexington	23,455	23,594	23,783	23,941	24,263 (4,853) [1,165] {582}	24,556 (4,911) [1,179] {589}	24,828 (4,966) [1,192] {596}
Richland	34,167	34,331	34,653	34,928	35,474 (7,095) [1,703] {851}	36,041 (7,208) [1,730] {865}	36,602 (7,320) [1,757] {878}
Spartanburg	28,286	28,505	28,661	28,988	29,644 (5,929) [1,423] {711}	30,262 (6,052) [1,453] {726}	30,903 (6,181) [1,483] {742}
York	21,152	21,285	21,476	21,640	21,979 (4,396) [1,055] {527}	22,307 (4,461) [1,071] {535}	22,618 (4,524) [1,086] {543}

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.