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

Date: 4/2/21

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 4/2/21 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.

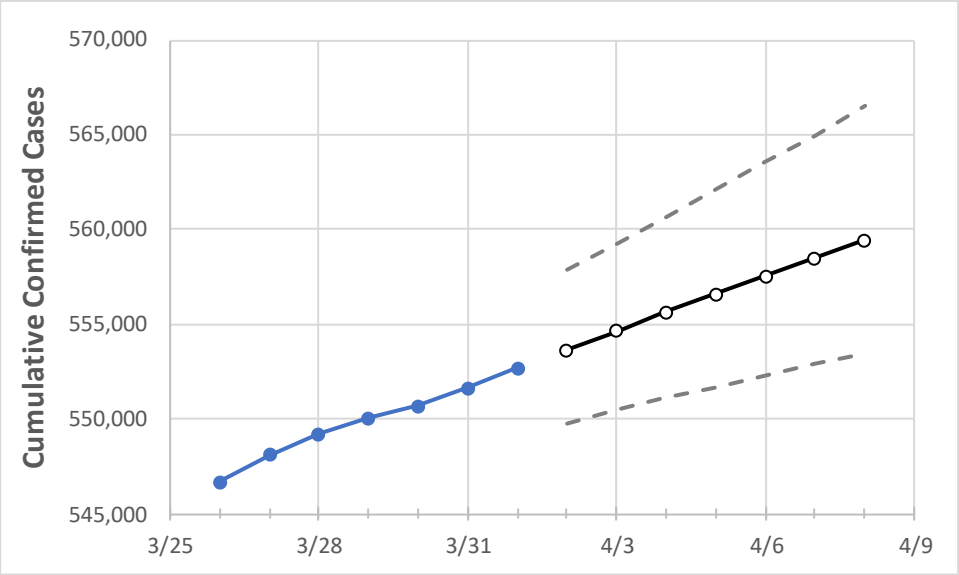
IEM's Modeling Lead

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
South Carolina	550,068	550,669	551,630	552,681	553,658	554,638	555,627	556,585	557,548	558,484	559,420

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Beaufort	16,226	16,244	16,253	16,262	16,278	16,295	16,310	16,325	16,340	16,355	16,369
Charleston	40,504	40,535	40,599	40,707	40,778	40,850	40,921	40,992	41,063	41,135	41,205
Greenville	69,112	69,241	69,416	69,620	69,831	70,042	70,257	70,471	70,684	70,903	71,125
Kershaw	7,038	7,046	7,058	7,067	7,077	7,086	7,096	7,106	7,115	7,125	7,134
Lexington	31,515	31,555	31,595	31,632	31,681	31,730	31,778	31,825	31,871	31,919	31,965
Richland	43,745	43,796	43,883	43,954	44,025	44,094	44,165	44,235	44,302	44,371	44,439
Spartanburg	38,647	38,697	38,783	38,916	39,026	39,135	39,248	39,361	39,474	39,587	39,703
York	28,509	28,550	28,620	28,694	28,750	28,805	28,860	28,916	28,970	29,026	29,077

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Beaufort	16,226	16,244	16,253	16,262	16,295 (3,259) [782] {391}	16,325 (3,265) [784] {392}	16,355 (3,271) [785] {393}
Charleston	40,504	40,535	40,599	40,707	40,850 (8,170) [1,961] {980}	40,992 (8,198) [1,968] {984}	41,135 (8,227) [1,975] {987}
Greenville	69,112	69,241	69,416	69,620	70,042 (14,008) [3,362] {1,681}	70,471 (14,094) [3,383] {1,691}	70,903 (14,181) [3,403] {1,702}
Kershaw	7,038	7,046	7,058	7,067	7,086 (1,417) [340] {170}	7,106 (1,421) [341] {171}	7,125 (1,425) [342] {171}
Lexington	31,515	31,555	31,595	31,632	31,730 (6,346) [1,523] {762}	31,825 (6,365) [1,528] {764}	31,919 (6,384) [1,532] {766}
Richland	43,745	43,796	43,883	43,954	44,094 (8,819) [2,117] {1,058}	44,235 (8,847) [2,123] {1,062}	44,371 (8,874) [2,130] {1,065}
Spartanburg	38,647	38,697	38,783	38,916	39,135 (7,827) [1,878] {939}	39,361 (7,872) [1,889] {945}	39,587 (7,917) [1,900] {950}
York	28,509	28,550	28,620	28,694	28,805 (5,761) [1,383] {691}	28,916 (5,783) [1,388] {694}	29,026 (5,805) [1,393] {697}

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.