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

Date: 1/22/21

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 1/22/21 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.

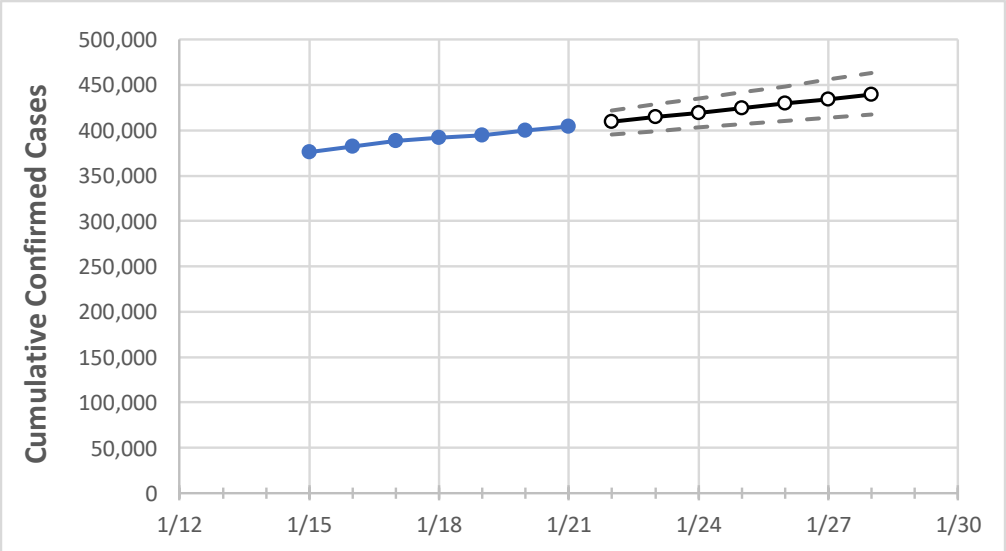
IEM's Modeling Lead

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
South Carolina	391,464	394,318	399,843	404,492	409,441	414,399	419,436	424,464	429,498	434,448	439,434

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Beaufort	11,781	11,829	12,124	12,346	12,492	12,640	12,794	12,943	13,104	13,262	13,418
Charleston	29,246	29,418	29,619	29,934	30,247	30,565	30,894	31,227	31,560	31,900	32,253
Greenville	49,327	49,626	50,646	51,285	51,901	52,510	53,136	53,745	54,378	54,976	55,572
Kershaw	4,895	4,934	4,984	5,035	5,094	5,157	5,219	5,282	5,347	5,412	5,477
Lexington	22,015	22,147	22,348	22,580	22,862	23,142	23,416	23,699	23,986	24,272	24,557
Richland	32,066	32,201	32,494	32,783	33,109	33,444	33,768	34,105	34,437	34,775	35,128
Spartanburg	25,271	25,479	26,681	27,091	27,525	27,984	28,439	28,910	29,397	29,905	30,397
York	19,775	19,958	20,127	20,290	20,522	20,750	20,979	21,200	21,437	21,663	21,893

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:		
	1/18	1/19	1/20	1/21	1/23	1/25	1/27
Beaufort	11,781	11,829	12,124	12,346	12,640 (2,528) [607] {303}	12,943 (2,589) [621] {311}	13,262 (2,652) [637] {318}
Charleston	29,246	29,418	29,619	29,934	30,565 (6,113) [1,467] {734}	31,227 (6,245) [1,499] {749}	31,900 (6,380) [1,531] {766}
Greenville	49,327	49,626	50,646	51,285	52,510 (10,502) [2,520] {1,260}	53,745 (10,749) [2,580] {1,290}	54,976 (10,995) [2,639] {1,319}
Kershaw	4,895	4,934	4,984	5,035	5,157 (1,031) [248] {124}	5,282 (1,056) [254] {127}	5,412 (1,082) [260] {130}
Lexington	22,015	22,147	22,348	22,580	23,142 (4,628) [1,111] {555}	23,699 (4,740) [1,138] {569}	24,272 (4,854) [1,165] {583}
Richland	32,066	32,201	32,494	32,783	33,444 (6,689) [1,605] {803}	34,105 (6,821) [1,637] {819}	34,775 (6,955) [1,669] {835}
Spartanburg	25,271	25,479	26,681	27,091	27,984 (5,597) [1,343] {672}	28,910 (5,782) [1,388] {694}	29,905 (5,981) [1,435] {718}
York	19,775	19,958	20,127	20,290	20,750 (4,150) [996] {498}	21,200 (4,240) [1,018] {509}	21,663 (4,333) [1,040] {520}

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.