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

Date: 12/22/20

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 12/22/20 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.

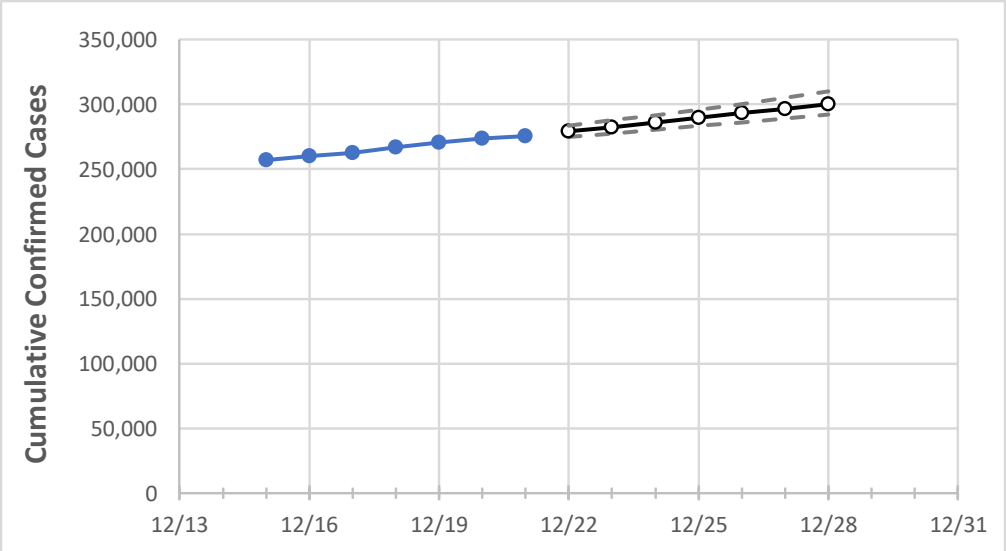
IEM's Modeling Lead

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
South Carolina	267,076	270,537	273,406	275,733	279,093	282,510	285,984	289,515	293,106	296,755	300,464

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 20%, and are often within 10%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Beaufort	8,460	8,532	8,606	8,642	8,731	8,822	8,915	9,010	9,107	9,207	9,309
Charleston	22,360	22,518	22,616	22,723	22,864	23,006	23,150	23,296	23,443	23,592	23,743
Greenville	31,117	31,676	32,207	32,546	33,077	33,621	34,179	34,749	35,332	35,930	36,541
Kershaw	3,469	3,499	3,531	3,547	3,582	3,618	3,655	3,693	3,732	3,772	3,813
Lexington	14,197	14,427	14,585	14,696	14,906	15,123	15,346	15,575	15,811	16,054	16,303
Richland	23,915	24,088	24,246	24,404	24,627	24,854	25,085	25,321	25,561	25,805	26,054
Spartanburg	16,665	16,871	17,277	17,408	17,689	17,976	18,269	18,570	18,877	19,191	19,511
York	12,980	13,223	13,294	13,448	13,630	13,813	13,997	14,184	14,372	14,561	14,752

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:		
	12/18	12/19	12/20	12/21	12/23	12/25	12/27
Beaufort	8,460	8,532	8,606	8,642	8,822 (1,764) [423] {212}	9,010 (1,802) [432] {216}	9,207 (1,841) [442] {221}
Charleston	22,360	22,518	22,616	22,723	23,006 (4,601) [1,104] {552}	23,296 (4,659) [1,118] {559}	23,592 (4,718) [1,132] {566}
Greenville	31,117	31,676	32,207	32,546	33,621 (6,724) [1,614] {807}	34,749 (6,950) [1,668] {834}	35,930 (7,186) [1,725] {862}
Kershaw	3,469	3,499	3,531	3,547	3,618 (724) [174] {87}	3,693 (739) [177] {89}	3,772 (754) [181] {91}
Lexington	14,197	14,427	14,585	14,696	15,123 (3,025) [726] {363}	15,575 (3,115) [748] {374}	16,054 (3,211) [771] {385}
Richland	23,915	24,088	24,246	24,404	24,854 (4,971) [1,193] {596}	25,321 (5,064) [1,215] {608}	25,805 (5,161) [1,239] {619}
Spartanburg	16,665	16,871	17,277	17,408	17,976 (3,595) [863] {431}	18,570 (3,714) [891] {446}	19,191 (3,838) [921] {461}
York	12,980	13,223	13,294	13,448	13,813 (2,763) [663] {332}	14,184 (2,837) [681] {340}	14,561 (2,912) [699] {349}

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.