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

Date: 1/12/21

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 1/12/21 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.

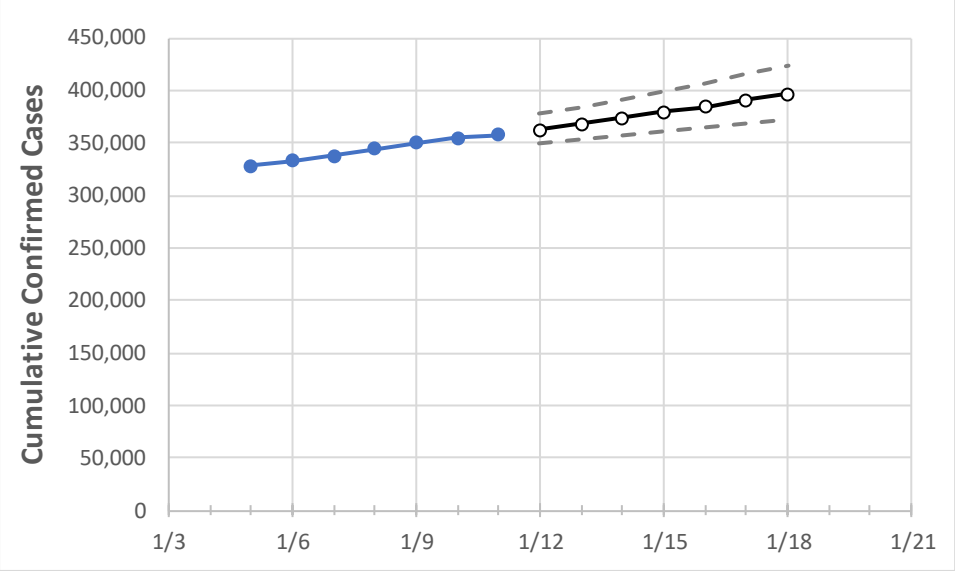
IEM's Modeling Lead

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
South Carolina	344,176	350,084	354,525	357,654	362,742	368,013	373,430	379,022	384,691	390,661	396,660

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:						
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18
Beaufort	10,627	10,772	10,915	10,958	11,079	11,198	11,322	11,445	11,578	11,708	11,849
Charleston	26,238	26,782	26,967	27,180	27,520	27,870	28,248	28,633	29,049	29,480	29,920
Greenville	43,176	43,922	44,698	45,085	45,843	46,609	47,400	48,195	49,016	49,858	50,688
Kershaw	4,316	4,362	4,392	4,425	4,483	4,541	4,598	4,658	4,721	4,789	4,855
Lexington	19,081	19,375	19,622	19,795	20,100	20,415	20,739	21,069	21,412	21,758	22,116
Richland	28,757	29,164	29,345	29,571	29,904	30,248	30,604	30,966	31,357	31,748	32,149
Spartanburg	22,273	22,612	23,119	23,360	23,714	24,077	24,447	24,832	25,232	25,616	26,017
York	17,305	17,614	17,788	17,911	18,171	18,431	18,704	18,982	19,253	19,534	19,821

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:		
	1/8	1/9	1/10	1/11	1/13	1/15	1/17
Beaufort	10,627	10,772	10,915	10,958	11,198 (2,240) [537] {269}	11,445 (2,289) [549] {275}	11,708 (2,342) [562] {281}
Charleston	26,238	26,782	26,967	27,180	27,870 (5,574) [1,338] {669}	28,633 (5,727) [1,374] {687}	29,480 (5,896) [1,415] {708}
Greenville	43,176	43,922	44,698	45,085	46,609 (9,322) [2,237] {1,119}	48,195 (9,639) [2,313] {1,157}	49,858 (9,972) [2,393] {1,197}
Kershaw	4,316	4,362	4,392	4,425	4,541 (908) [218] {109}	4,658 (932) [224] {112}	4,789 (958) [230] {115}
Lexington	19,081	19,375	19,622	19,795	20,415 (4,083) [980] {490}	21,069 (4,214) [1,011] {506}	21,758 (4,352) [1,044] {522}
Richland	28,757	29,164	29,345	29,571	30,248 (6,050) [1,452] {726}	30,966 (6,193) [1,486] {743}	31,748 (6,350) [1,524] {762}
Spartanburg	22,273	22,612	23,119	23,360	24,077 (4,815) [1,156] {578}	24,832 (4,966) [1,192] {596}	25,616 (5,123) [1,230] {615}
York	17,305	17,614	17,788	17,911	18,431 (3,686) [885] {442}	18,982 (3,796) [911] {456}	19,534 (3,907) [938] {469}

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.